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S. D. KIRKPATRICK, Editor

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NEW IMPETUS TO AN OLDER URGE

"CHANCES are 20-to-1 that you will see decentralization of industry expressed in legislation before the next Congress adjourns." Thus recently spoke one of the most responsible of the newer officials of the Federal Government. To this a well-known business commentator added: "Decentralization of industry will be the most important New Deal development during the remaining years that President Roosevelt will be in office. . . . He wants to demonstrate that business can operate as profitably under a decentralized system as it can massed in large centers, and that the people will thereby be infinitely better off. He will emphasize to industry—and this is very important—that he has no disposition whatsoever to deprive it of its profits. He knows that his program will have to start modestly and that years will be required to make it generally effective."

Except for its high sponsorship, there is nothing new about this program—at least as far as the process industries are concerned. And the recent migration to the South of some $35,000,000 worth of new chemical plants is convincing evidence that something more than a modest start has already been made. Yet it all serves most effectively to bring home to the chemical engineer the increasing importance of a field of activity that he has too long neglected. Plant location must, and eventually will, be placed on a more scientific, engineering basis. Much of this issue of *Chem. & Met.* is devoted to that premise—to show both by precept and example the underlying forces that have been responsible for recent trends.

No section of the country stands to gain more than the South through any sound program for the decentralization of industry. The potentialities in her mineral, agricultural and timber resources have long been appreciated, but only recently have other factors risen to determining influence. Transportation has changed greatly as the railroads have awakened to the competition of new waterways and improved shipping facilities on the one hand, and, on the other, to the greater use of trucks over our rapidly expanding highway system. Not only are costs reduced but the presence of nearby plants means that much more satisfactory service can be given customers. Thus improved transportation may be regarded as one factor likely to check the tendency of some industries to set up chemical plants to supply their own needs.

Another fundamental factor effecting plant location is the availability of cheap electric power, particularly in the Southeast. Even more important is the changing situation with regard to fuel and power costs. Petroleum and natural gas in close association with essential raw materials and adjacent to seaboard or rivers where cheap water transportation is afforded to both domestic and foreign markets—that is the practically unbeatable combination responsible for so much of the recent industrial development of the Southwest.

We are not in agreement with those New Dealers who feel that this great urge for industrial decentralization needs any stimulus from Federal legislation. That might even prove a handicap. Rather, the move will be brought about by industry itself. What we are witnessing now is only the start of an even greater migration. Chemical industry is a lodestone certain to attract to itself other industries essential for a diversified industrial development. The South stands ready to gain, not at the expense of the rest of the country, but because it, too, will grow and prosper as a consumer.

EDITORIALS

Centralizing Medical Authority

NO GOVERNMENTAL FUNCTION is more important than protection of the public health. Uncle Sam rightly has many laws, administrative regulations, and inspection responsibilities to protect our health and safety. This type of activity is widely distributed through the Federal Government. And amazingly, unfortunately too, there is no centralization of authority and no single competent medical supervision.

In the next Congress a new food and drug bill will be introduced. Probably some such new law will be enacted. It would have been passed by the last Congress had not more urgent economic legislation intervened. It is none too soon now to begin to formulate the new food and drug law for even the latest form of bill before the last Congress was imperfect in many particulars.

Such a law might well be the vehicle for providing a central medical supervision for the medical and public health functions of the Government. All legal practices of executive departments and independent establishments are subject to rulings of the Attorney General. That is as it should be with reference to law. There should be an analogous supervision and final office of technical review in medical matters. It appears that the Surgeon General of the Public Health Service is the logical official of the Government to exercise such function.

It will be well to have this matter thoroughly investigated and discussed during the next few months. It appears that the Manufacturing Chemists Association would be a logical agency to take the leadership from the standpoint of chemicals and chemical industry. We hope that M.C.A. will soon find an opportunity to study this problem and determine what form of legislation may deserve support. Then in the next Congress when the next food and drug bill is formulated, such provisions can be presented to Congress as amendments in a suitably mature and accurate form.

Nature Provides Use For T.V.A. Fertilizer

FERTILIZER COMPANIES have justifiably been worried as to whether the Government is going to make and market a lot of fertilizer in competition with them. Now Nature comes to the rescue. She is providing Uncle Sam with a real need for large quantities of fertilizer so that there is no necessity for looking for a market for the T.V.A. production.

The drought effects in the Middle West show an extreme case of denudation and soil damage because of excessive tillage and inadequate ground cover. This need is equally apparent in the Southern territory, where sheet erosion and gullying go on at an appalling rate.

Some of this land must be restored to forest area. Other parts are logical grazing territory. But whether grazing or forests are the ultimate objective, the immediate effort must be to get a grass cover. Some of the land is so badly depleted in plant food as to require artificial fertilization even for this purpose.

Here is the right place to use the bulk of T.V.A. production of fertilizer. And, too, some small quantities of fertilizer may be used for demonstration purposes to persuade farmers to use more fertilizer where they need it. Neither of these plans will interfere with the sound development of the commercial industry. Furthermore, the experiment of proving how cheap fertilizer can be made by new processes can go on just as well even with the Government as its own customer.

In passing, however, it is worth while to remark that the fertilizer industry should watch T.V.A. technical improvements closely and be willing to adopt them promptly if and when successes are demonstrated. Furthermore, the industry must continue aggressive development of sales practice to reduce the spread between factory cost and farm price. Prompt adoption of new technology and aggressive effort in merchandising offer the fertilizer industry the most persuasive argument against governmental invasion into this field of private business.

Rooseveltian Research on Resources

WHILE President Roosevelt was away from Washington this summer some of his earnest followers were busily engaged in a group of fundamental studies that are of particular interest to chemical engineers. It now appears that these surveys were designed to give the administration an elaborate factual basis on which to formulate its natural resource policies. Process industries are already being asked to cooperate in some of these investigations so it is desirable that they be viewed in proper perspective.

First of importance to chemical engineers is the National Power Survey, organized as an agency of the Federal Power Commission to make a comprehensive inquiry as to the power resources of the nation and the costs of power production, transmission and distribution. The unit in the organization that will deal with power-user problems, is made up of responsible and experienced electrical and electrochemical engineers who are now conferring with industrial leaders and otherwise carrying on their fact-finding work. Policy-making will, of course, come later, presumably by the Power Commission or some other agency to be named by the President.

Minerals are perhaps of next closest interest to our field. Here the agency is the Planning Committee for Mineral Policy, set up some weeks ago with Secretary Ickes as chairman. Active direction is under Dr. C. K. Leith of the University of Wisconsin, who has been selected by the committee itself as its vice-chairman. The purpose of the planning committee, officially stated, is to "consider such questions as the estimating

of future consumption, the curtailment of production, the coordination of emergency appropriations, the relationship between Federal and State control, the treatment and conservation of the Nation's mineral resources and the effect of mineral tariffs." A large task, to be sure, but a desirable one if a general mineral policy is to be established.

Land itself is the subject of a third group of separate studies not yet fully coordinated. One deals with erosion prevention, another with soil fertility, one with sub-marginal land retirement and there are perhaps others with more specialized themes. A land planning committee, largely within the Department of Agriculture, is contemplated but has not yet been given as full power as the projects previously cited.

Water is viewed as a natural resource by the National Planning Board and as such may become the subject of a much more elaborate study than the definite program on waterway development which is now in progress. In its full form such a survey would deal with all types of water utilization. This means, of course, industrial water supply will be studied, a question of great importance to chemical engineering industry.

Forestry affects many other projects, including land policy, water resources, and the agricultural activities of the Administration. The Forest Service has for years been making a broad investigation and last year reported a recommendation of an American forest policy to Congress. That project affecting wood supply for many chemical industries is, of course, of concern in the chemical engineering field.

As a result of these various surveys and investigations, a national resource policy is to be formulated. A series of bills will be introduced into the next Congress. Then will begin the political, regional and economic arguments and the log-rolling. For the present, however, the investigations are essentially fact finding and it is therefore important that industry cooperate in order that these Rooseveltian researchers shall obtain sound, technically accurate, comprehensive facts.

Another Light That Failed

A GREAT LIGHT of understanding, seeming to herald a new day in governmental control of industrial alcohol, appeared momentarily in the Treasury Department early this month. Methanol, according to Press Service Release No. 2-43 of Aug. 2, was to be returned to its logical position as the premier denaturant for completely denatured alcohol. Thus was to be corrected an injustice that had been done almost four years ago when the Department had yielded to a public clamor against "poison alcohol" and had banned methanol from all except the special formulas. Producers, users and distributors hailed the good news of Aug. 2 as the long awaited answer to their prayers. Only a promised Treasury Decision was necessary to return a less odorous, and therefore more acceptable, industrial alcohol to its former competitive position in the markets for solvents and anti-freeze compounds.

Instead, with the abruptness of a bombshell, came Press Service Release No. 2-50 of Aug. 10 stating in a single sentence that on the authority of the Secretary of the Treasury "no such Treasury Decision would be issued at this time and the whole matter has been postponed indefinitely." Treasury officials refused to give any formal explanation and none of the resulting speculations of our Washington correspondents seems wholly satisfactory to us. There can be no doubt that the Secretary of the Treasury has been grossly misled as to the merits of this case. He has done more than merely "postpone indefinitely" the promised formulas. His blundering decision, unless quickly corrected, is going to cost chemical industry many thousands of dollars. But most discouraging is the return to the dark path of ignorant bureaucracy when we were beginning to see a light pointing the way to a New Deal that would be a Fair Deal for industrial alcohol.

Rail vs. Water Transportation

SO MUCH has been said in this issue and elsewhere regarding the advantages of water transportation that one might gain the impression that the railroads are of only minor importance to our new chemical industries. Nothing could be farther from the truth. Barge transportation has its limitations, both in the handling of raw materials and the distribution of finished products. There are few materials that can be shipped in bulk on the same basis as sulphur or coal. Most chemicals to be shipped by water must be packed in bags or barrels unless the shipments are sufficiently large to require specially constructed barges or the chartering of an ocean vessel. On the other hand, the freight car is still a convenient unit for handling many bulk chemicals. Since most barge rates are now based on 80 to 85 per cent of the freight rates for the equivalent water distance, it is apparent that this differential may often be offset merely by the additional costs of containers and of packaging.

It is even quite probable that in the near future we may see shipments of chemicals from the Southwest to Atlantic ports by a combination of rail and water facilities. New "seatrains" that will accommodate almost 100 freight cars, are in regular service between New Orleans and Havana and are growing in popularity. Loading has been speeded up to such an extent that these vessels can completely discharge and reload in ten hours as contrasted with several days for an average vessel handling the same volume of freight. With this and other devices, the railroads are giving evidence that they are awakening to their opportunities and responsibilities as agencies for more efficient transportation of the products of industry.

An attempt to show how the play of fundamental forces—economic and technologic—influenced the selection of these new focal centers for chemical industry:

WHY THESE NEW CHEMICAL

SIX CASE STUDIES IN PLANT LOCATION

By S. D. KIRKPATRICK
Editor, Chemical & Metallurgical Engineering

DURING a period in which the prophets of gloom were busy burying all hopes of further industrial development and while certain of the codists were trying to apply their birth control schemes to new processes and products, chemical industry embarked on a tremendous program of expansion and new construction. The country over, more than $100,000,000 has been spent or set aside for the building of new plants. At least a third of this total is represented by six important projects that dot our Southern coast-line from Wilmington, N. C., around the Gulf Coast to Corpus Christi, Tex.

On several occasions in recent years it has been our editorial privilege to visit this territory and to discuss its relation to the future growth of both chemical producing and chemical consuming industries. (See *Chem. & Met.* special theme numbers in Jan. 1926, Nov. 1929, and July 1932). Therefore, it is with some degree of gratification that we can now record the impressive developments of recent months. As we see it, this program of industrial migration has only started. The same factors that attracted chemical producing industries to this Southern territory are certain to attract consuming industries. With these, in turn, will come the other industries of a diversified industrial development. What are the economic and technical factors that have been responsible for this important trend? Perhaps if it were possible to show how they have been studied and applied in these six projects, we might find the basis on which this further progress is bound to rest.

As Drs. Perry and Cuno have pointed out elsewhere in this issue (see pp. 432 to 436), these fundamental economic and technical factors in plant location are not fixed in number or relative importance. Each new plant presents a different problem. Some new locations are determined by the nature of the product, others by the raw material or fuel supplies, but in every case there will be a strategic balancing of all of these factors. Hartford, in one of the best articles that have been published on chemical plant location (*Chem. & Met.*, Feb. 1931, pp. 72-75), lists at least twenty such factors in various combinations or circumstances.

When the International Nickel Co. located its large rolling mill in Huntington, W. Va., back in 1922-3, a committee of the company's executives made a thorough engineering study of a large number of locations. In order that there might be a definite means of comparing and evaluating the different locations studied, this committee set up a series of relative weightings for the various economic and technical factors. As reported in some detail by R. S. McBride (in *Chem. & Met.*, Vol. 29, p. 745ff.) these relative weightings were as follows:

Factor	Relative Weight	Factor	Relative Weight
Fuel	330	Transportation	50
Labor	250	Construction Cost	20
Power	100	Taxes and Laws	20
Living Conditions	100	Water Supply	10
Raw Materials and Supplies	60	Plant Site Selection	10

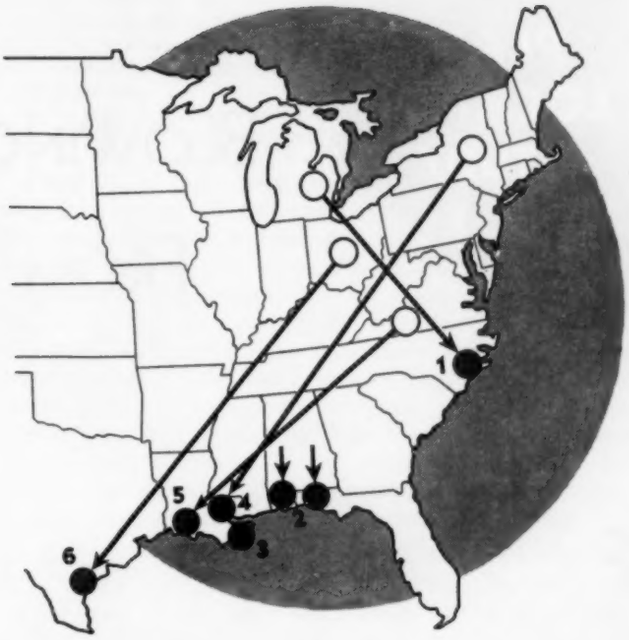
Unfortunately comparable data are not available for all of the new chemical plants in the South, but as one who has visited these projects in various stages of their development, I should like to try my hand at evaluating the influencing factors. Before discussing in detail the plant location problems of these different industries, let us take a broad look at the companies involved.

All six are branches or offshoots of established organizations in chemical industry. Two are jointly owned subsidiaries, each representing new combinations of producer-consumer groups. Three are in the alkali industry, thus definitely establishing either a decentralization or a re-centralization of that important heavy chemical industry. All except one are chemical producing rather than consuming industries, which is perhaps significant.

What then are these six case studies we have to draw on?

1. Ethyl-Dow Chemical Co., jointly owned subsidiary of the Dow Chemical Co. of Midland, Mich., and the Ethyl Gasoline Corp. of New York, whose new plant near Wilmington, N. C., was built to exploit a new process for recovering bromine from sea water. This plant is unique in that it has only one product and one customer. With the whole Atlantic Coast to choose from, why was the particular site at Kure Beach selected? Geography and topography give the clue.

INDUSTRIES "WENT SOUTH"



1. Ethyl-Dow Chemical Co., Wilmington, N. C.
2. Southern Kraft Corp., Panama City, Fla., and Mobile, Ala.
3. Freeport Sulphur Co., Lake Grande Ecaille, La.
4. Solvay Process Co., Baton Rouge, La.
5. Mathieson Alkali Works, Lake Charles, La.
6. Southern Alkali Corp., Corpus Christi, Tex.

Cape Fear offered the opportunity to tap the old Atlantic Ocean for raw material, pump some 35,000,000 gal. per day across the narrow peninsula, extract the bromine and dump the waste water into Cape Fear River, where it must travel some twenty miles before it can dilute the bromine content of the Atlantic Ocean. The selection of a plant site followed an extremely interesting history and an extended survey by chemical engineering executives.

2. Southern Kraft Corp. is the subsidiary of the International Paper Company that operates six mills in Southern States from Arkansas to Florida, representing an investment of about $35,000,000 and producing almost a third of the kraft wrapping paper and board used in the United States. Two plants completed during the depression at Panama City, Fla., and Mobile, Ala., are model mills that show what can be accomplished in this territory. Are these kraft mills forerunners of an equally important white-paper industry based on a great resource, southern pine?

If so, then Southern Kraft's experience, both in plant location and operation, may prove of interest and value to the industry.

3. Freeport Sulphur Co. completed its remarkable new plant at Lake Grande Ecaille, La., late in December, 1933, after a year of tremendously difficult construction (see *Chem. & Met.*, March, 1934, pp. 116-120) that followed eight long years of patient search for sulphur along the entire Gulf Coast. Why was it necessary to go out into the swamps of the Mississippi Delta to build this plant under such discouraging difficulties? Of course, the answer to this important problem in plant location in a few words is simply that that is where the Almighty put the sulphur. But it will be of interest to note how such factors as transportation of supplies, water, labor, housing, etc., involved their particular problems and how they were solved.

4. Solvay Process Co., largest of the alkali producers and the last to announce its plans for a Southern plant, chose a Mississippi River site at Baton Rouge, La., only after at least a dozen years of study and investigation. The story of how the various factors were balanced in making the final decision over a competing site in Texas must remain untold, at least officially, but perhaps we may speculate on the interplay of interesting forces involved. Mississippi River transportation, an attractive contract for power and steam, or was it the desire to be the most easterly point of a triangle, pointing in the direction of its largest market?

5. Mathieson Alkali Works, original Southern pioneer since its ammonia-soda plant at Saltville, Va., has been in operation for more than 40 years, went to Lake Charles, La. This is historic territory for chemical industry, because it was here that the old Union Sulphur Co., pioneers of the Frasch process 35 years ago, operated so successfully until the deposits were exhausted in 1924. Why Lake Charles? Here again a careful balancing of many factors: transportation, raw materials, fuels, labor and even the lay of the land itself. Again there is a story we can only hint at here, but Mathieson's interesting experience in plant location, once it can be published, would be of inestimable value in directing the trend of chemical and chemical consuming industries.

6. Southern Alkali Corp., jointly owned subsidiary of the Pittsburgh Plate Glass Co. and the American Cyanamid Co., chose Corpus Christi, Tex., as the site for its impressive development which is now in the final stages of its construction. (See "Progress Report of April 15, 1934," in May issue of *Chem. & Met.*, pp. 253-256). But the history of this project goes back to 1926 and a certain chemical-banker's vision of a great diversified chemical industry in the Southwest. Cheap power at tidewater was perhaps the primary consideration, but again there was a balancing of values in this process of translating the theory of plant location into the practical terms of brick and mortar.

In the pages that follow, these six case studies are reported in greater detail in text, pictures, maps and charts of plants and processes. To the many individuals and companies that have cooperated in supplying information and pertinent data, *Chem. & Met.* extends this expression of grateful acknowledgment. Their total contribution will surely help to direct the future growth and development of chemical industries not only in the South, but along all of the frontiers of industrial progress.

PLANT LOCATION STUDY No. 1

BLOWING BROMINE FROM THE SEA

FORT FISHER, you may recall, was the scene of one of the greatest bombardments of the Civil War. This stronghold at the tip of Cape Fear, N. C., guarded one of the last ports of entry through which the Confederate Capital at Richmond was able to draw its supplies in spite of the ever-tightening Federal blockade. Finally, it fell early in 1865, but it required the combined efforts of the Federal fleet of 55 war vessels and a land force of 2,000 sailors and marines. Today only some crumbling ruins, a few rusty cannon ball and a monument mark the site of the historic struggle. But just a few miles to the north is another monument—not to the destructive forces of war, but rather to one of the most constructive achievements of modern industry. The unique plant that cuts across the narrow peninsula, in fact, utilizing in part one of the old trenches of the Civil War engagement, is making history of a different sort. It stands as a tribute to the resourcefulness of the research chemists and chemical engineers of the Dow Chemical Co. Here, in the last few months of 1933, and the early part of the present year, was completed a carefully planned and beautifully executed chemical engineering achievement—the successful translation into large scale production of one of science's most striking miracles, namely, the commercial recovery of bromine from sea water.

To get the story behind the story of the Ethyl-Dow Chemical Co., it is necessary to go back ten years into the history of the parent companies, the Dow Chemical Co. of Midland, Mich., and the Ethyl Gasoline Corp. of New York, for whose bromine requirements this plant was built. Ethyl gasoline in 1924 was still in an uncertain stage of its development. Thomas Midgley, Jr., its resourceful inventor, and his sponsors in General Motors, early realized that the lack of an adequate supply of bromine might prove the limiting factor in developing a national market for their new anti-knock compound. A year was spent in a vain search for a substitute. In the Fall of 1924, in cooperation with the Dow Chemical Co., a world survey of the possibilities of bromine production led to the inescapable conclusion that the largest and probably the most convenient source was the sea—even though its bromine content of 60-70 parts per million was actually less than that of the waste waters from the most efficient extraction plant in the world.

Atlantic Ocean's bromine content as revealed on S. S. Ethyl's famous voyage in 1925

The late Dr. Herbert H. Dow was among the first to appreciate the magnitude of the problem, in fact he was ready with a most original solution. Why not build a pipeline, pump the water of the Pacific over the Rocky Mountain divide into a desert lake and there let solar evaporation concentrate the brine to the point where the bromine could be commercially extracted? Why not? There is no reason to believe that the process would not work—except that it would have meant an almost prohibitive expenditure.

A more modest attack seemed desirable and so Midgley conceived the idea that it might be possible to extract the bromine from the sea water directly, in the form of an organic bromide that might itself be used in the Ethyl fluid. Working along this line, Dr. Graham Edgar, then director of research for the Ethyl Gasoline Corp., developed the tribromoaniline process (see U. S. Patents 1,662,304 and 1,662,355). It seemed to have possibilities for large scale application, and late in 1924, the duPont company was persuaded to try it out in an experimental plant built at Ocean City, Md. The troubles encountered here were the first indication that plant location was perhaps the most serious problem before a sea water bromine industry.

Then came the novel suggestion of Mr. Irénée duPont that the plant should be built on a boat. Accordingly the good ship *"Ethyl,"* whose adventurous voyage was chronicled in the newspapers and the technical press in

the Spring of 1925, was duly equipped to treat sea water with chlorine, sulphuric acid and aniline at the rate of 7,000 gal. per minute. The steamship made a single trip to sea late in April, 1925, following the route indicated in the accompanying map, which appeared in the comprehensive report by Dr. Stine published four years later in the May, 1929, issue of *Industrial & Engineering Chemistry*. Some minor difficulties were encountered which probably would have been overcome later had the Ethyl Gasoline Corp. seen fit to continue the work. However, at that time it was having difficulties of another sort as a result of the crusading attack of Professor Yandell Henderson and the late *New York World*.

During all this time Dr. Dow had been an interested observer, but his chemists and physicists had also been busy in the research laboratories of the Dow Chemical Co. He was convinced that the direct process used at Midland could be economically applied to sea water if properly modified and refined. The Dow process consists of three stages, namely, oxidation with chlorine, blowing the bromine out of the solution with air, and finally absorbing in a soda-ash solution. After several years of patient research the officers of the Dow Chemical Co. had the pleasure of reporting to the Ethyl Gasoline Corp. that their process had been developed to the point where it was practical to apply it on a large scale to the production of bromine from sea water. Then came the task of finding a suitable location for a pilot plant. From experience learned at Ocean City, and confirmed by Dow research, it was agreed that the principal plant location requirements in the order of their importance were as follows:

1. A full, high-sea concentration of bromine (67 ppm) hence undiluted by fresh water streams.
2. Absolute minimum of organic matter capable of absorbing chlorine—hence absence of sewage and industrial wastes.
3. A suitable current or an adjacent river for removing the treated water so that it would not dilute the intake.
4. Warm water the year around.
5. Adequate transportation for supplies and finished products.
6. Reliable source of electric power.
7. A relatively small but intelligent labor supply.

From this it is apparent that the plant location problem was largely one of topography and geography rather than economics and technology. But it was also a problem that could not be settled by Chamber of Commerce propaganda. As a matter of fact, what was wanted was just about the opposite of most industrial requirements. The plant had to get away from large cities, since populations follow fresh water and fresh water dilutes the ocean and carries organic pollution. Railroads follow populations and don't go near the ocean otherwise. Power and labor are in the same category. It was agreed that a field study was necessary and accordingly a party of chemical engineering executives of the Dow Chemical Co., headed by its president, Willard H. Dow, and including among others E. O. Barstow, production manager, and I. F. Harlow, chief inorganic chemist, made a comprehensive study of the entire Eastern and Southern coastlines of the United States. Their conclusions, on which the commercial plant was later built, have been summarized as follows in a private communication from LeRoy C. Stewart of the Dow Chemical Co., whose paper on this plant and process was one of the features of the St. Petersburg meeting of the American Chemical Society (see *Ind. & Eng. Chem.*, April, 1934, p. 301 ff.):

"Geographical location was the chief reason for building the Ethyl-Dow plant on the peninsula extending south from Wilmington, N. C. With the Atlantic Ocean on the east side of the peninsula and the Cape Fear River on the west side, the location was ideal for pumping undiluted and uncontaminated sea water only a short distance to the bromine extraction plant and discharging the effluent into the river, which would take it back to the ocean far enough away so as to avoid contamination of the incoming water.

"The geography of the plant site also provides sea

Here, extending across the narrow peninsula of Cape Fear, N. C., is the new $3,500,000 plant that finds and saves the proverbial needle in the haystack—one ounce of bromine in every five tons of seawater! Every minute of the day, 26,000 gal. is pumped through the plant, and its bromine is recovered to produce each month a half million pounds of ethylene dibromide

(Photograph supplied by Aerial Explorations, Inc.)

water and air of moderate or warm temperature throughout the year. From standpoint of operating efficiency, this has an advantage which could not be obtained from locations in the northeastern states.

"The Ethyl-Dow Chemical Co. differs from practically all other chemical plants in that it has only one customer, at Carney's Point, N. J. Hence, it was desirable to locate the plant as close as possible to this one consumer and still obtain the benefits already mentioned.

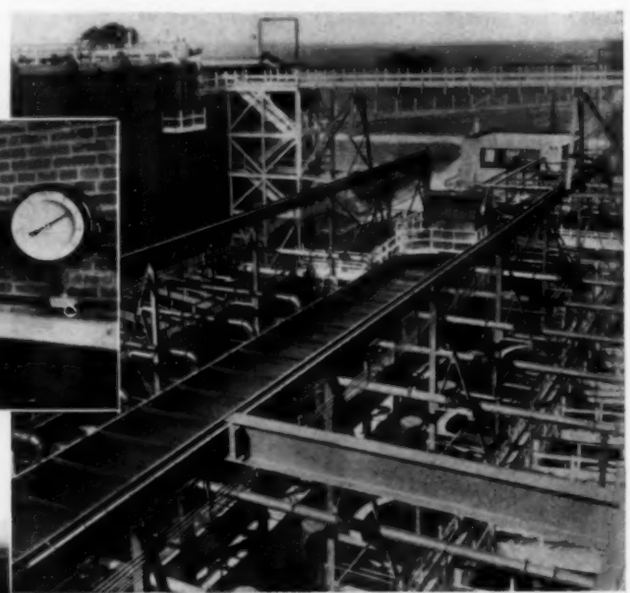
"Other factors which influenced the selection of the location for the plant involved availability of (*a*) raw materials and supplies, (*b*) labor and (*c*) power. The chief raw materials that are employed are sulphuric acid, chlorine and alcohol. All of these are available reasonably close to the site which was selected. The location is also sufficiently close to industrial centers along the Eastern seaboard, as well as being only an overnight haul from Pittsburgh, so as to afford convenient sources of other supplies, maintenance material and equipment. Other locations farther south which were considered did not offer these advantages. Likewise, because of the proximity to Wilmington, a source of labor was at hand. Then, too, in a locality which was selected, the Tidewater Power Co. was equipped to furnish ample electric power following the construction of a 20-mile power line.

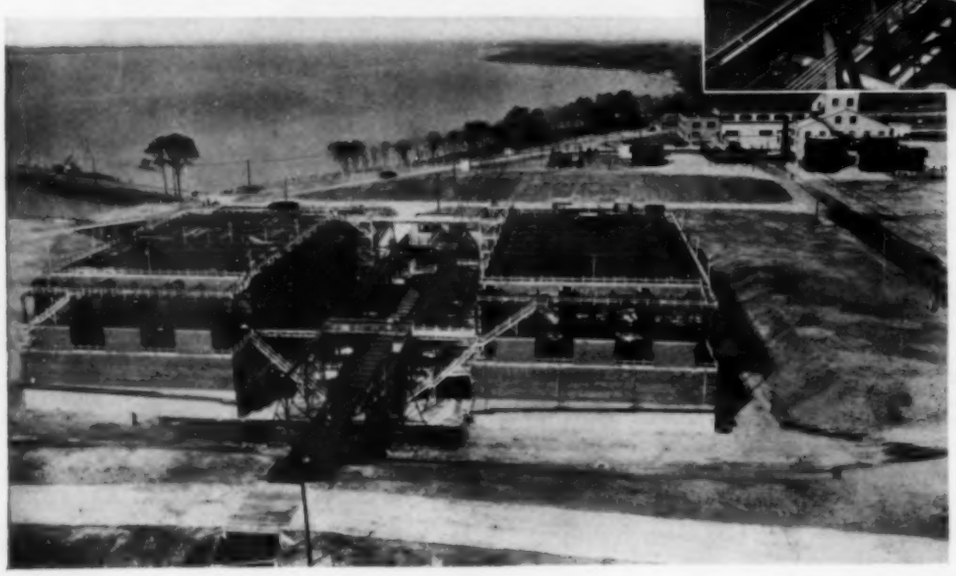
"Naturally, transportation facilities were considered. Actually they were very poor. Wilmington, N. C., is the nearest railroad depot. This necessitates hauling supplies 20 miles by truck or by boat on the Cape Fear River. Potentially, however, the transportation situation is fairly good. If and when tonnage to be transported becomes heavy enough, some additional dredging in the Cape Fear River would enable ocean boats to dock at the plant's wharf.

"Other factors which ordinarily influence the location of a plant were studied, but were of such minor importance as compared with the geography of the location that their effect was negligible."

The accompanying illustrations are indicative of the scale of operation in the construction of the commercial plant that followed six months' successful operation of the pilot plant. At one time as many as 1,500 men were employed in the construction project, which was completed and in operation in an even five months. Every feature of design, construction and operation except the building of some of the housing facilities was executed by the Dow Chemical Co. The plant is in charge of G. S. Dressel, a graduate in chemical engineering from Michigan State College, assisted by M. C. Shigley, assistant superintendent. The officers of the company are: Willard H. Dow, president; Dr. Graham Edgar, vice-president and Arthur E. Mittnacht, secretary-treasurer.

Electrometric control by specially designed, recording and indicating instruments is the real key to the sea-water-bromine process





The huge brick and steel structures at the left are the "towers" in which the bromine is blown from the seawater after it has been brought to a pH of 3 to 4 by addition of dilute sulphuric acid (about ¼ lb. per ton of seawater) and enough chlorine added to liberate the heavier halogen. The released bromine is absorbed in 5 per cent soda ash solution to produce sodium bromide-bromate

PLANT LOCATION STUDY No. 2

SOUTHERN KRAFT POINTS THE WAY

THREE of the great kraft paper mills of this Southern subsidiary of the International Paper Co. are on deep water. Another group of three is clustered in Northern Louisiana and Southern Arkansas. In their aggregate these six mills have a total capacity of 1,400 tons a day—roughly 30 per cent of the country's output. The Camden, Ark., Panama City, Fla., and Mobile, Ala., mills were built by the Southern Kraft Corp., the others were purchased. The Mobile and Panama City mills (see *Chem. & Met.*, Aug. 1931, pp. 440-4) were built during the depression and represent most modern practice in plant location. SKC's experience in selecting sites surrounded by a virtually inexhaustible wood supply with adequate transportation for raw materials and finished products points the way to what may be expected as the Southern paper industry comes into its own.

Its six Southern plants are shown here. At the top is the newest, Panama City, Fla., below are the two at Bastrop, La., and next is the Camden, Ark. plant. Mobile (Ala.) mill is at the bottom and in the circle at the left is Moss Point, Miss., where sulphate will soon be bleached to produce another form of white paper from Southern pines

PLANT LOCATION STUDY No. 3

FREEPORT'S SEARCH FOR SULPHUR

Nine new sulphur wells at Lake Grande Ecaille, La.

WHAT was the scientific basis on which the Freeport Sulphur Co. decided to locate its new $3,500,000 plant at Lake Grande Ecaille in Louisiana? The answer might be that this just happened to be the place where the Creator hid the sulphur, perhaps for the purpose of meting out appropriate punishment to those engineers who later were to collaborate with the Devil in producing molten brimstone. In this sense then the basis for the location of this new industry might be considered one of religion rather than of science.

After a visit to that remarkable plant which was described so completely in our March issue, I am quite willing to concede the point. Certainly a faith of even greater than religious intensity must have been necessary to visualize and carry out this great project under such tremendous handicaps. If you have never seen the tidal marsh "land" of the Mississippi River delta, you probably could not picture a more unfavorable terrain for engineers to conquer. Its low, flat, uninhabited expanse is a network of shallow lakes and bayous, separated only by brown, fibrous masses of decayed vegetation that literally float on a gummy ooze of alluvial drift, fine sand and unctuous clay. Canals had to be built to bring in all equipment and supplies, and the plant itself was built on several hundred miles of piling. But that story has already been told in our March issue, so this account must be confined to the reasons that led to Freeport's famous search for sulphur.

In 1905 the United States produced 220,000 tons of sulphur, compared with Italy's output of 559,942 tons. Ten years later our production mounted to 520,582 tons out of a total world production of 963,231 tons. By the end of another ten years, this total had practically doubled, reaching 1,732,440 tons, while our output had almost trebled to reach 1,409,262. In the meantime, the Italian production had dropped to 290,241 tons. To support such a rapidly expanding market for a basic industrial raw material, adequate reserves become a primary consideration. The experience of the old Union Sulphur Co. in Louisiana, which was later confirmed in Texas, proves that the productive capacity of any Gulf Coastal sulphur mine is highly variable. Realizing the need for reserves, the Freeport company first supplemented its production at Bryanmound by acquiring in 1922 the sulphur rights at Hoskins mound in Brazoria County. The same purpose stimulated continuous search for additional deposits, especially during the last eight years.

Prior to 1925, practically all of the known salt domes were limited to those having surface expressions in the form of mounds or elevations above the surrounding terrain. But the oil industry's use and perfection of geophysical instruments, such as the torsion balance and the seismograph, has resulted in the discovery of perhaps more than a hundred salt domes that were heretofore unknown. It is significant that with a single exception, drilling tests for sulphur have always followed tests for oil.

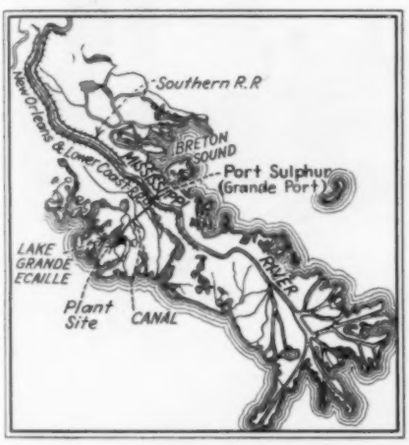
The first domes to be drilled were those having surface indications or flank extensions of cap rock shown by the torsion balance. This was followed by the prospecting of domes previously located through the use of the seismograph. Both instruments were valuable tools in the six-year prospecting program of the Freeport Sulphur Co. During that time, ten domes were prospected for sulphur, four located in Texas, and six in Louisiana. The final choice, of course, was the Lake Grande Ecaille or Lake Washington dome in Plaquemines Parish.

This dome had been discovered in 1928 by seismograph, and the mineral rights secured by the Humble, Gulf and Shell companies. Prospecting for oil was begun in 1929 by Humble, whose drilling operations first encountered sulphur water at about 1,735 ft. Core drilling later revealed sufficient sulphur to warrant prospecting for this mineral, and after Freeport had made its deal with the three oil companies and acquired the sul-

phur rights, it began its own prospecting in April, 1932. All of this had to be done with specially designed floating equipment, which came to be known locally as the "sulphur navy." It is not surprising, therefore, that it took a year to drill and sample the first 18 wells. Simultaneously, a torsion balance survey determined the size, depth and configuration of the cap rock area.

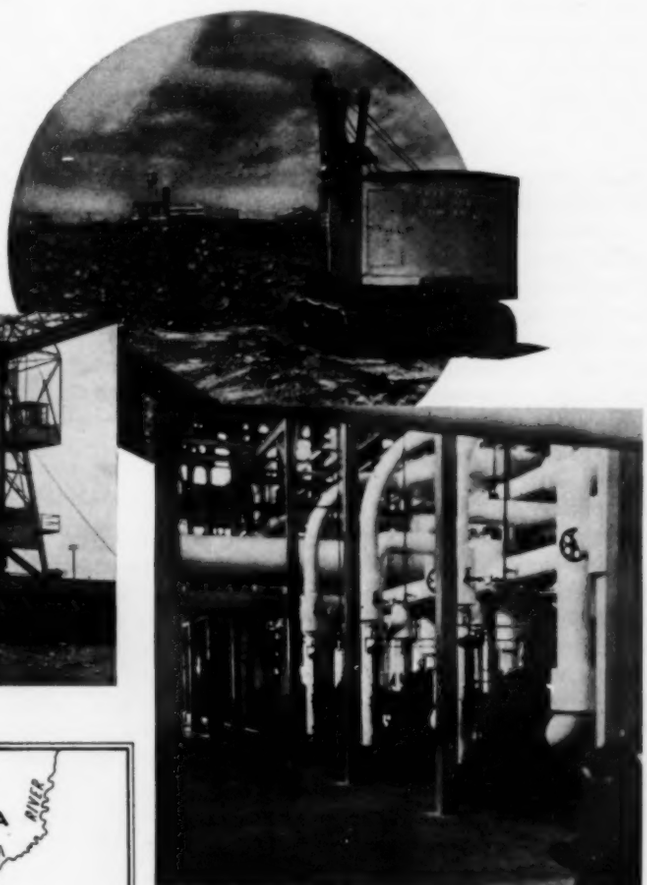
Only when these investigations brought forth their favorable results was the company ready to consider the other plant location factors involved in the selection of a sulphur producing property. What are they? In their order of importance, according to Freeport engineers, they are: (1) Fresh water supply; (2) transportation facilities; (3) terrain conditions; (4) fuel supply; and (5) bleed water disposal. Obviously at Lake Grande Ecaille there had to be a balancing of all of these factors—some of which were fairly favorable, as for example, the quantity and quality of Mississippi River water once the huge storage reservoir was completed, and the plant built for chemical treatment. Transportation, on the other hand, proved extremely difficult and costly, and from what has already been said about terrain conditions, it is apparent that they proved a highly negative factor. But each problem in turn was solved and the complete plant, which made its first commercial shipment last December, is a model of efficiency and marvelous engineering construction.

Now the company is turning its attention to another phase of the project—to provide homes, schools and recreation facilities for its employees. The terminal of Freeport's ten-mile canal is Port Sulphur (once called Grandeport), conveniently located on the Mississippi River, a paved highway and the New Orleans & Lower Coast Railroad. Today a complete new town is under construction there. Seventy-six attractive frame houses, with asbestos shingle roofs, electrically wired and equipped with modern plumbing facilities are being pushed to completion. Stores, schools, and a community recreational center are to be built. A playground and parks are being developed. So, perhaps, after all, there is a religion involved in this process of transforming an ugly, desolate swamp into a thriving industry and a little city of attractive homes for Freeport's employees.



Mississippi River Delta showing Freeport's plant site

Handling sulphur with steam shovel at the mine and with ship loading gantry at the canal bulkhead in Port Sulphur

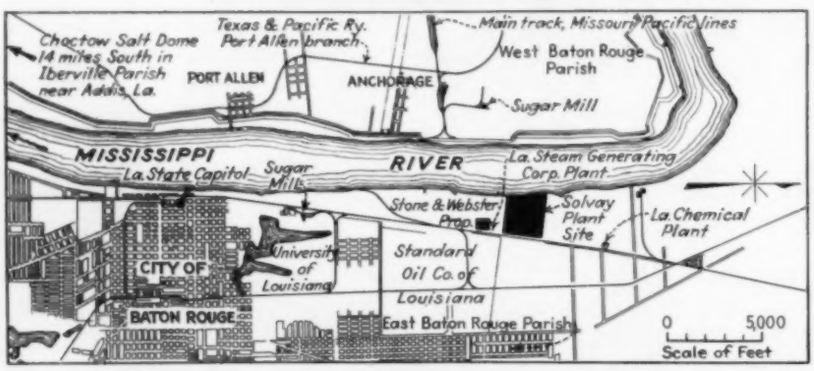


In Freeport's power plant, an engineering palace

At left, sulphur domes in the Gulf-Coastal region as shown in 1934 edition, special map supplement to the "Oil Weekly" of July 16, 1934

PLANT LOCATION STUDY No. 4

SOLVAY'S SOUTHERN SITE



An old sketch of Solvay's plant at Syracuse, N. Y. and a map showing the new plant site at Baton Rouge, La.

ABOUT fifteen years ago, in December, 1919, to be exact, the Solvay Process Co. sent two of its technical men, an engineer and a chemist-photographer, down into the Southwest on a secret mission. One might have guessed that this was but part of a general expansion program which for 30 years had kept Solvay in the position of the largest American producer of alkalis. Its first expansion outside of Syracuse was the erection of the new plant at Detroit in 1897. In 1915, Solvay took over a small plant at Hutchinson, Kans., which helped to meet the heavy wartime demands, although operation was subsequently discontinued. In 1917 a Canadian works was built at Amherstburg. So in 1919, it might have seemed logical to look to the Southwest, where salt in abundance was providing increasing competition for New York State producers.

It is significant that these investigators, after an extended study of prospective locations for a new alkali industry, recommended that the most favorable site was on the banks of the Mississippi River at the town of Port Allen, La. Thirteen years later, in September, 1932, another group of Solvay investigators visited the same territory. Before they left they had secured an option, not on land, but on a tentative contract for steam and power. It so happens that the Louisiana Steam Products Co., which is a Stone & Webster property, was located at Baton Rouge, directly across the river from Port Allen. So it finally turns out that on Friday, June 15, 1934, Solvay announced to the world that its new Southern plant will be at Baton Rouge. And that in keeping with its traditions it intended to continue to be the largest producer of alkali in the world.

The plant location story, however, was not nearly as simple as this might seem. As a matter of fact, enthusiastic chambers of commerce and prognosticating editorial writers during the past few years have had this plant located on nearly every important salt dome in the Southwest. Even as late as January, 1934 (see *Chem. & Met.*, p. 38), it looked to some of us as though Houston, Texas, was still in the running, with Freeport, perhaps close behind. What happened to throw the choice to Baton Rouge? That is the story, but we must again begin back with those Solvay scouts who came to Huey Long's town in September, 1932. They had no trouble in negotiating a tentative and apparently favorable contract with Louisiana Steam Products and its related public utility, the Baton Rouge Electric Co. This huge central station described in *Chem. & Met.*, April, 1932, pp. 198-9, generates steam at a boiler pressure of 670 lb. To pass its surplus on to a next door neighbor who could extract its power and utilize the low-pressure steam for process use, is good business for all concerned. It also emphasizes another community of interest for this same power plant uses as fuel, the waste still gases of its neighbor, the Standard Oil Co. of Louisiana, which in turn is paid for this gas in process steam and electrical energy. Surplus is sent out over the local utility's transmission lines.

Once an attractive arrangement had been worked out for steam and power, the Solvay investigators next took

an option on 26 acres of land owned by the power company, 46 acres from a local citizen, K. H. Knox, and 10 acres from the Louisiana & Arkansas Railroad, embracing some of the Mississippi River front property, which the old Louisiana Railway & Transportation Co. had purchased years ago as a site for a bridge across the mighty river. Thus, with its river frontage, Solvay had options on a plant site of approximately 80 acres.

There remained the important problem of securing an adequate brine supply. The Solvay party of 1919 had looked at the salt dome at Hackberry, south of Lake Charles in Cameron Parish, but that was obviously out of the question now, because it is the property of Mathieson. Furthermore, it is too far away and the oil companies' vigilant geologists had since spotted a number of more convenient structures. One of these is Choctaw dome in Iberville Parish, about 14 miles south of Baton Rouge, but on the west side of the river. It was owned by the Wilbert Mineral Co., but all mineral rights except a one-eighth royalty interest had been leased to Gulf Refining Co. The Solvay negotiators quickly reached an agreement with the Gulf company, but the one-eighth royalty interest of the Wilbert's proved a difficult stumbling block. In December, 1933, after three months of unsuccessful negotiations for these salt rights, the Solvay officials withdrew and transferred their activities to the Houston area, where some favorable developments had occurred.

Early in 1934 it looked as though Baton Rouge had lost its chance. Then some of its citizens interested themselves in the salt negotiations, and as a result of their gentle persuasion, the Solvay company was able, in March, to buy the salt dome at terms that revived interest in a Mississippi River plant site. The first published intimation that Baton Rouge had won its contest came April 16, when the *Manufacturers Record* of Baltimore published a brief news item to the effect that Solvay had let a contract for 5,000 tons of structural steel to be used in a new plant at Baton Rouge—just getting under the wire for first quarter steel prices.

On Friday, June 15 (see *Chem. & Met.*, p. 329), came the official announcement from Syracuse that the Solvay Process Co. would built "a completely integrated alkali plant on river-front property at Baton Rouge, La." No reference was made to the size of the operation, although local representatives stated that several millions of dollars would be spent, that at least 1,000 men would be employed in the erection of the plant and 400 in its operation.

This brings up the pertinent question asked so often in connection with the whole alkali development in the Southwest: Is there really a market for the 300,000 to 350,000 tons which these three plants (Solvay, Mathieson and Southern) will probably be able to produce? Frankly, it is a difficult question to answer. Even in its best years, the Southwest consumed only a little more than 100,000 tons of soda-ash—petroleum being the most important consumer, glass second, and soap a sorry third. Of course there has been a small export trade to South America, which with the much larger consumption of the Orient (reached through the Panama Canal), might total as much as 500,000 tons in a good year. Furthermore, as mentioned in the Solvay announcement, that company alone has a "captive market" of several hundred thousand tons a year represented by soda-ash consumption of its associate company, the Atmospheric Nitrogen Corp. at Hopewell, Va. But perhaps the best answer of all to those who are pessimistic as to the future, is the history of the growth of the alkali industry, which in normal times has shown an average annual increase of around 100,000 tons. There has been no substantial increase in alkali capacity since 1930.

Helping an old Cajan in Hackberry to utilize a newly discovered resource-natural gas

Louisiana transportation has improved since these early Solvay scouts investigated a prospective plant site near Port Allen, La.

PLANT LOCATION STUDY No. 5

MATHIESON ALKALI CHOOSES LAKE CHARLES

Ammonia-soda plants in relation to Houston market (prior to 1934)

ON JANUARY 21, 1927, the late President Coolidge signed a rivers and harbors bill that provided, among other things, $16,000,000 for the construction of the Intra-Coastal Canal, "from the Mississippi River at or near New Orleans to Corpus Christi, Texas." When completed—and that day is not far off—this will provide a land-locked waterway with a 9-ft. depth and 100-ft. bottom width for 600 miles, connecting Louisiana and Texas through barge transportation to the entire Mississippi and Ohio River basins. The advantages of such a transportation system are immediately apparent to any student of plant location. Not so obvious, however, is the fact that this great project opened up for industrial development an area that was rich in mineral resources and cheap fuel—two most important considerations for heavy chemical industries.

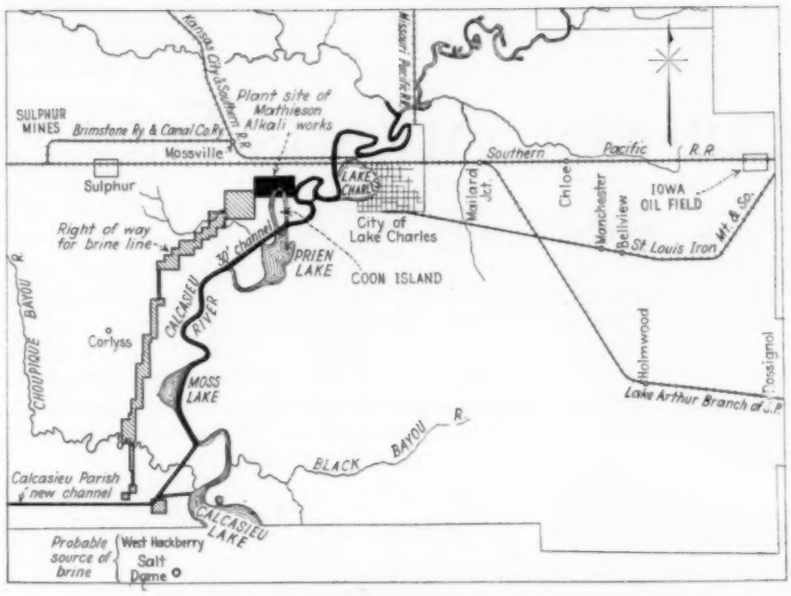
Just who among the big chemical companies was the first to visualize the opportunities of this immediate territory is not definitely known to this writer. At least five or six years ago, however, a group of independent engineering investigators went into the Gulf Coast region to look around. There hadn't been a new alkali plant built in the United States since 1917, and they thought that perhaps the time was ripe for a new factor to enter this old industry. After a thorough study that encompassed practically every salt dome in this salty terrain, their choice settled on a spot in Texas not far from the Louisiana line, and, of course, on deep water. Plans were drawn for a new ammonia-soda plant that would incorporate many new features of technology. The site was selected and options taken on most of the land, including the necessary source of brine. But, as is sometimes the case, one landowner proved a "hold-out" for reasons which his heirs no doubt now have reason to regret. However, there was a depression developing elsewhere in this country, and this little group of would-be pioneers decided to mark time with their project.

Meanwhile, the progress of this particular investigation was being watched with a lot of interest by all the members of the alkali industry, since more than one of them had had his eyes on this territory. The most interested observer was probably the Mathieson Alkali Works, since its Saltville, Va., plant was the most favorably located alkali works for serving this Southern and Southwestern district. Nor was its very progressive and aggressive management in the habit of running away from a fight when its principal markets were endangered.

So Mathieson, too, was attracted to this particular territory, and when an opportunity came to pool forces the Texas site was abandoned in favor of a better location on the west shore of Lake Charles, La. On Friday, December 1, 1933, the following announcement appeared in a special "red-line" extra of the *Lake Charles American Press:* "The selection of Lake Charles as the site of the new plant of the Mathieson Alkali Works is the result of an exhaustive study for five years of the most advantageous location, not only for serving the company's customers in the rapidly-growing South and Southwest, but also from consideration of raw materials and distribution facilities, and location at tidewater." This announcement was made by Mr. I. V. Maurer, Mathieson representative, who later was to be appointed manager of the new plant and construction project.

What were the advantages that Lake Charles had to offer this new enterprise? Reference has already been made to the new Intra-Coastal Waterway, which means that as far as inland water transportation is concerned the site is ideally situated. Ocean vessels inbound for Lake Charles enter the Sabine Channel, proceed north to Port Arthur, then across the Neches River near its mouth, east on the Choupique cutoff, and through the Calcasieu River and its chain of lakes to Lake Charles. A more direct route across Calcasieu Lake only awaits dredging of a deeper channel through the shallow waters at the mouth of the Calcasieu River.

A primary consideration with Mathieson management was that their site should be served by at least two railroads. As shown by the accompanying map, Lake Charles is most fortunate in that respect, for it is a terminal of the Kansas City and Southern Railroad to the



Rail and water transportation facilities had most to do with the selection of Mathieson's new site

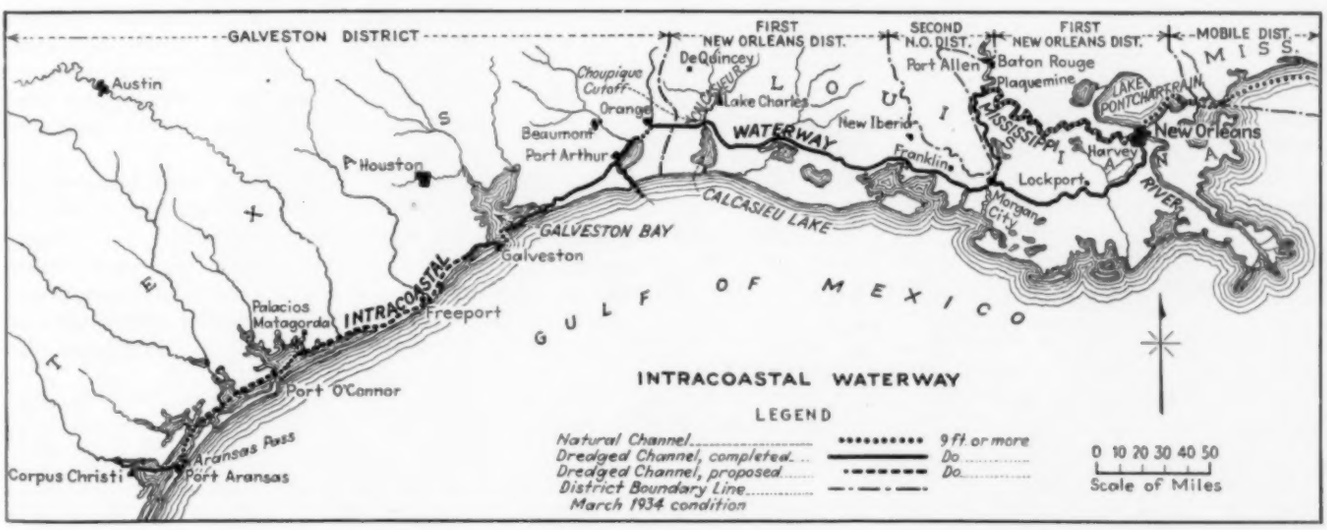
northwest, and is on the main east-west line of the Southern Pacific. Likewise, it is the southern terminal in Western Louisiana for the Missouri Pacific and is only a few miles south of the Gulf Coast lines, owned by the Missouri Pacific.

The actual plant site consists of about 1,650 acres in Calcasieu Parish, lying to the south of the Southern Pacific and bisected by the new Federal concrete highway between Lake Charles and Sulphur. The southern line of the site runs just north of the Lake Charles oilfield, and east to the Calcasieu River. Near the center of the property is the horseshoe bend known as Old River, on which the company docks are being erected. The channel here is being deepened and dredged for a 45-ft. clearance. Rail transportation will be provided by spur tracks jointly owned by K. C. & S. and S. P.

The probable source of brine is a well drilled in Cameron Parish on the West Hackberry salt dome, about 15 miles south of the plant site. Drilling has been carried to a depth of 2,100 ft., indicating a salt deposit of at least 1,000 ft. in thickness. The company owns about 350 acres of salt land, and has acquired the right-of-way for its brine line from at least 125 individual small owners. A 12-in. pipe line of calked cast-iron construction is being built at an estimated cost in excess of $20,000 per mile.

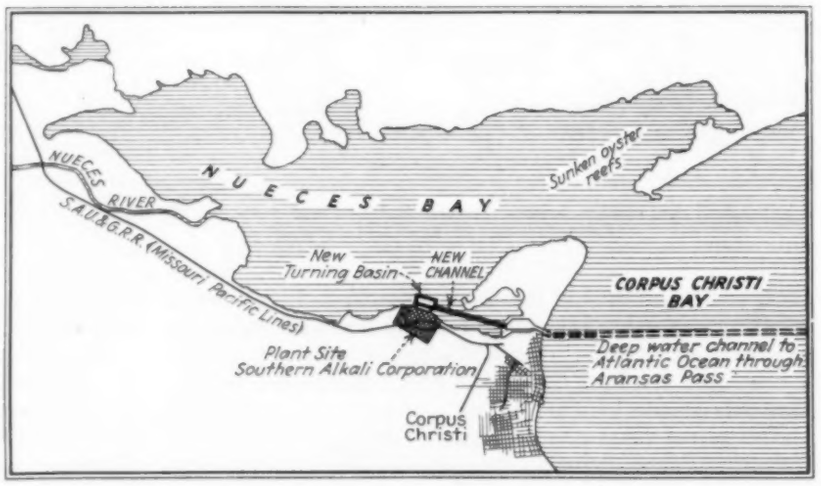
Actual construction was started December 20, 1933, and it is estimated that the plant will be in full operation by January, 1935. At the time of the writer's visit to Lake Charles in April, much of the steel had been erected and some of the heavier equipment was being put into place. It was interesting to note that much of the equipment will not be housed as is necessary in a Northern climate. In the design of the buildings, steel structures sufficiently strong to withstand a 150-mile-per-hour hurricane wind were used. In one building alone, which will house the caustic soda equipment, it was necessary to use 1,000 tons of steel beams and girders. Much of this was supplied by the Virginia Bridge & Iron Works.

Although the ammonia-soda process is to be used in the new plant, its design includes a number of unique features representing the most advanced technology in alkali production. A new technique will also be employed in salt mining, which is said to greatly increase the recovery per well. Of the other raw materials, the most important is lime, which will be produced either from oyster shells, which are available in abundance from deposits found in the bays of the region, or from limestone brought in by rail. Birmingham coke and synthetic ammonia from the company's own plant at Niagara Falls will also reach the plant by rail. Both oil and natural gas are available for fuel. In every respect, this promises to be one of the most modern units in the alkali industry and may itself be the center of an important development of chemical-consuming industries. Already there are reports of consuming projects, such as glass, soap and other sodium and potassium compounds.



PLANT LOCATION STUDY No. 6

SOUTHERN ALKALI'S SITE ON THE SEA



Where natural gas at tidewater built an alkali plant

A CHEMICAL investment banker, a young engineer, a newly-opened Southern seaport and a natural gas well within sight of tidewater. With these four elements, the plant location story of the Southern Alkali Corp. started back in 1926. The banker was Colonel Frederick Pope of New York, whose chemical business first took him to Southeastern Texas to look into a proposed sulphur development. The young engineer, who met him at the train at San Antonio and provided the car that took him down to the coast, was Ralph R. Lewis, now president of the Power Cost & Engineering Co. of San Antonio. Arriving in Corpus Christi, they found that historic old town in the throes of feverish activity. The channel dredging and harbor improvement project authorized by the Federal Government in 1922 was practically completed. On September 14, 1926, the port of Corpus Christi was to be formally opened. Eight years from that date it is the hope and expectation of the officials of the Southern Alkali Corp. that its $6,000,000 plant may likewise be formally opened. But we are far ahead of our plant location story.

As the banker and engineer drove westward from the city, Colonel Pope sighted a derrick being erected on a nearby farm. To make conversation, perhaps, he casually asked his companion what type of well was being drilled. Lewis replied, laconically, "Gas." To the trained mind of the chemical banker, that meant something more than just another billion feet of gas to light a city or to be wasted to the heavens. Natural gas at tidewater meant to him the possibility of industrial development. More specifically, he probably associated it with a great synthetic nitrogen industry—for one of Colonel Pope's interests was the Nitrogen Engineering Co., which was later sold to the American Cyanamid Co. However, the fact remains that the immediate project in which Colonel Pope was interested failed to materialize. He returned to New York, and the secretary of the local Chamber of Commerce closed his file with a discouraging notation: "A lot of work done on a dead proposition!"

But actually it was very much alive—in Colonel Pope's fertile mind. When in Paris in 1929, he completed the transaction with William B. Bell for the sale of his engineering firm, he learned from the president of the American Cyanamid Co. how that organization had searched in vain for a plant site where natural gas was available at tidewater. Immediately recalling what he had seen at Corpus Christi, three years before, he told Mr. Bell that he thought he had a solution for Cyanamid's problem. Pope hurriedly returned to the United States, and in October, 1929, he arrived in Corpus Christi, this time by airplane. He sought the advice of Richard King, a capitalist of the famous King Ranch family, and after the Colonel had unfolded his story and left the office, the local banker remarked: "There goes the biggest man who ever came to Corpus Christi—or the damndest fool!"

Colonel Pope returned a few days later accompanied by W. S. Stowell, then chief engineer of American Cyanamid. Some intensive investigations were begun immediately. One of these was made by an independent engineering authority, whose voluminous report completed late in 1930 compared in greatest detail the economic and technical advantages and disadvantages of a

EDITOR'S NOTE: *For the interesting anecdotes on which this very human story was largely based, we are indebted to Dale Miller, enterprising young associate of Peter Molyneaux of* The Texas Weekly. *The part that virile journal is playing in the industrial development of the whole Southwest is already well known to many* Chem. & Met. *readers.*

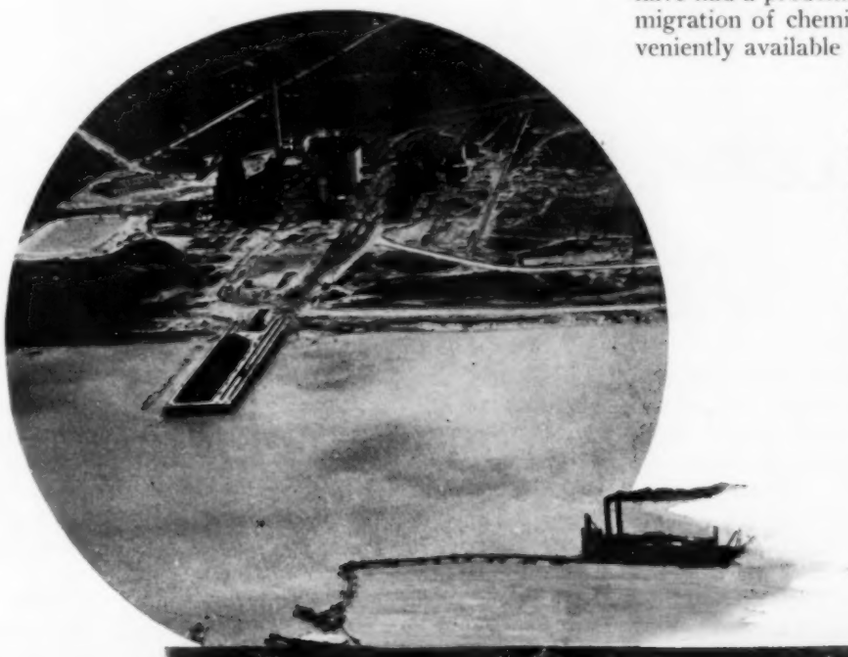
half dozen different locations in the Southwest, having in mind primarily a diversified heavy chemical industry producing both ammonia-soda-alkali and synthetic sodium nitrate. In the end his recommendation narrowed down to Corpus Christi and Houston, with cheap natural gas the single most important advantage to the former.

About this time another factor entered the picture. The Pittsburgh Plate Glass Co., through its Columbia Alkali division, was one of those in the alkali industry that foresaw a greater industrial development in the Southwest. In fact, the parent company had contributed to the movement by building a large window glass plant at Henryetta, Okla. It saw in American Cyanamid an ally rather than a competitor, for both were large users of alkalis. To further their common purposes, the Southern Alkali Corp. was formed to be jointly owned by the two large corporations. Two subsidiaries were also created immediately, a Southern Mineral Corp. to own and produce mineral raw materials and the Southern Pipe Line Corp. to transport brine and fuel. More recently another, the Southern Chemical Corp. was created to develop the production of chemicals other than alkalis.

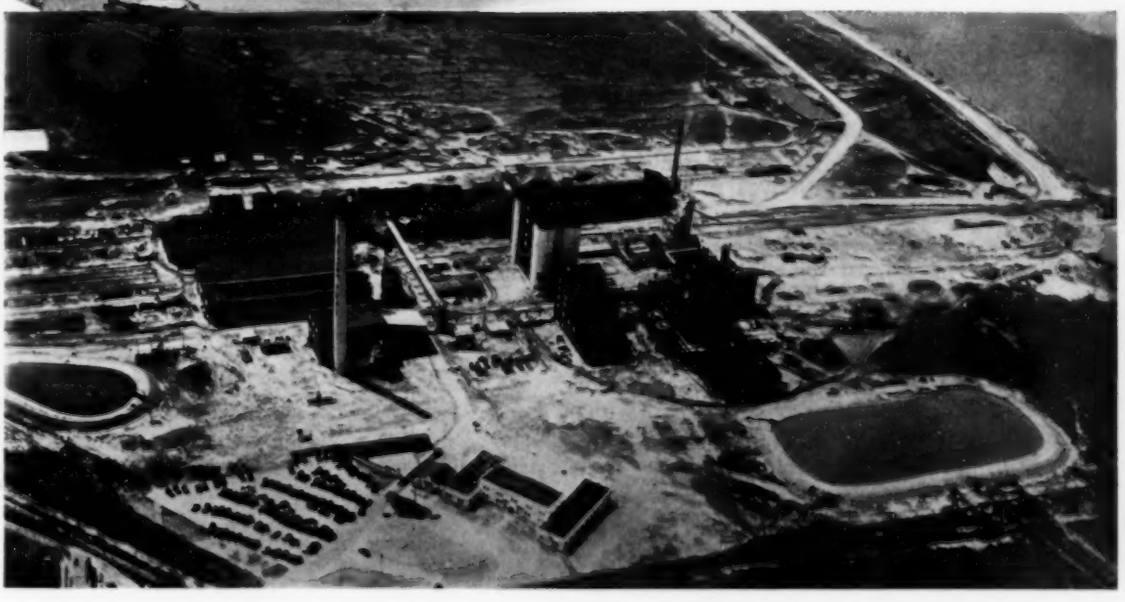
Even after the merger was effected, however, it was some time before its sponsors felt that economic conditions were such as to warrant going ahead with the construction project. Finally, on August 21, 1933, came the definite announcement that the plant would be rushed through to completion. Its progress from that date until the time of the writer's most recent visit to Corpus Christi in mid-April, was reported in the May issue of *Chem. & Met.* (see pp. 253-6). The illustrations that accompany the present article reflect its status as of August 1, 1934. From these it is evident that commercial operations are not far distant.

In Conclusion

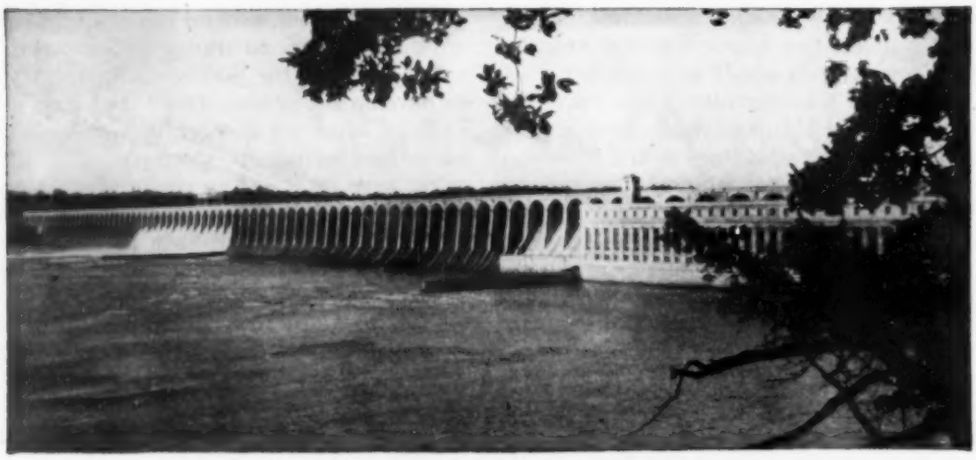
Summarizing in a paragraph these six brief studies, it is apparent that three major factors in plant location have had a predominant influence on the recent Southern migration of chemical industry: (1) Abundant and conveniently available raw materials; (2) better transportation as a result of improvements in waterways, docks, and shipping facilities, rail connections and paved highways; (3) low-cost fuel for power and process, available at tidewater. Advantages in labor, climate, taxes, etc., have been of contributory rather than of determining importance.



Looking at this new plant from Nueces Bay one sees first the 500 ft. dock to the turning basin which the dredge in the foreground is just now completing.



Below is the way the Southern Alkali Corp. looked from the air on Aug. 1, 1934. It will shortly go into commercial production after the "tuning-up" and testing operations are completed



Wilson Dam and power plant at Muscle Shoals as it appears today

WHAT ABOUT THE T.V.A. INDUSTRIAL PROGRAM?

By S. T. HENRY

Editorial Representative, McGraw-Hill Publications.

THIS QUESTION has been asked so many times in so many variations that I think it might best be answered for *Chem. & Met.* readers by briefly quoting from some of those in high authority. Chairman Arthur E. Morgan, for example, recently said: "What we are aiming at is the most desirable distribution of the various kinds of industrial enterprises, not necessarily the maximum of industrial development. We are studying the industrial question but we haven't the facts to say how much of this industry, how much of that, is needed * * * * I should like to have here in the Valley a big industrial research laboratory, publicly owned, operated for the public good, devoted to finding the best use of the region's resources."

David E. Lilienthal, director, predicts: "It is my firm conviction that the Tennessee Valley region is to be the scene of an expansion of industry which in the course of the coming decade will change the economic life of the South. If this industrial development is controlled in the interest of the entire community and fitted into a national program it will stimulate and regenerate industrial life of all America." More specifically, this T.V.A. director would encourage industries that use "new processes and new methods."

All seem agreed that most progress is to be looked for in the electrochemical and metallurgical industries that can utilize the great amounts of power that are or shortly will be available at estimated costs of 2 to 4 mills per kw.hr. As Major Edwin C. Eckel, T.V.A. geologist, recently wrote:

"In supplying cheap electricity to the T.V.A. region, we are not merely providing a cheaper source of mechanical power, but we are making possible the development of electrochemical and electrometallurgical industries which heretofore have been impossible of profitable operation owing to the high cost of electricity employed in the process. This fact opens up a number of entirely new fields for consideration of the industrialists and technicians of our region."

Without adequate raw materials, however, these industries could not advance. Hence industrial readers will find of interest T.V.A.'s first geologic bulletin "Engineering Geology and Mineral Resources of the Tennessee Valley Authority Region" by Edwin C. Eckel, published by T.V.A., June 1934. Summarized by uses, he has grouped these mineral resources as follows:

FUELS: Coal, lignite, petroleum, natural gas, cannel.
IRON AND STEEL: Iron ores, manganese, chromium, nickel.
LIGHT METALS: Aluminum, magnesium, beryllium.
OTHER METALS: Zinc, lead, gold, tin.
FERTILIZERS: Phosphate, potash schists and shales, greensand, niter, gypsum, lime, byproduct ammonia.
CHEMICALS: Salt, lime, alum, coal tar, pyrite, fluorspar.
CEMENT MATERIALS: Limestone, shale, clay, lime, gypsum, slag.
AGGREGATES AND ROADS: Stone, sand, gravel, slag, chert, asphalt.
CERAMICS: Clays, shales, kaolin, feldspar.
PIGMENTS: Ocher, metallic paint, pyrite, barite, carbon black, zinc white, coal tar colors, slate colors.
ABRASIVES: Bauxite, corundum, emery, garnet, sand.
REFRACTORIES AND INSULATORS: Kyanite, asbestos, mica, fire clays, bauxite, olivine, vermiculite.
MISCELLANEOUS: Talc, graphite, fullers earth, glass sand, bentonite.

Fertilizer and Research Program

From the viewpoint of the chemical engineer, however, most interest undoubtedly centers in Muscle Shoals and the program for fertilizer development there. Under the act creating T.V.A., the latter was directed to undertake the manufacture of fertilizer. In accordance with this direction, a new fertilizer plant is now being built at Muscle Shoals. In this plant phosphate rock is to be smelted in two electric furnaces, and the resulting phosphorus converted to phosphoric acid and eventually to triple superphosphate. The plant as a whole abounds in new devices and new methods, in keeping with the spirit of the T.V.A. act which emphasizes repeatedly that the purpose of the program is to be the improvement of manufacturing technique and the cheapening of products.

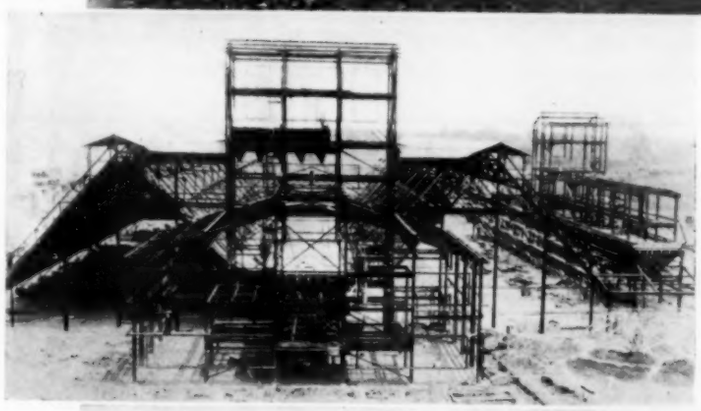
Aside from the electric furnace plant, T.V.A. has financed the operation for several months of an experimental, phosphorus-producing blast furnace and now has under consideration several blast furnace designs. This method of producing phosphorus is to be tried out in comparison with the electric furnace process.

An active research and development program on fertilizer producing processes has also been under way for several months in the T.V.A. laboratories at Knoxville, and the Shoals. There are indications that this program of research is to be expanded to include work on various mineral products of the Valley and on other of the natural resources. For example, a recent newspaper release states that $100,000 has been earmarked by T.V.A. for experimental work in coal processing.

An appropriation of $3,500,000 has been made by T.V.A. for its fertilizer program. As a part of the latter the fertilizer plant is being constructed at Muscle Shoals, utilizing some of the existing building and equipment of Nitrate Plant No. 2.

The accompanying pictures give an idea of the character, layout and status of the fertilizer construction. The electric furnaces being installed have a rated capacity of 8,000 kw. with an ordinary input of around 6,000. One of these furnaces was designed by R. C. Heaton of the Chemical Engineering Division of T.V.A. and the other by W. E. Moore & Co. of Pittsburgh. Plans for the plant were prepared and are being executed under the direction of Stone & Webster of Boston. One of the phosphoric acid units and the electrical precipitation installation for both units were designed and are being erected by the Research Corporation of New York.

Dr. Harry A. Curtis, chief chemical engineer of the T.V.A., is in general charge of the fertilizer project under Dr. Harcourt A. Morgan, T.V.A. director. When the new plant is completed at Muscle Shoals Arthur M. Miller is to be general superintendent and William Jones, chief chemist.



Progress on T.V.A. Fertilizer Plant

At top. Early stages of construction, April 14, 1934. *Next below.* Mixing, storage and shipping units as they appeared, July 2, 1934. *Third from top.* In foreground, two phosphoric acid precipitating units under construction; in background are Nitrate Plant No. 2 buildings to be used in drying, grinding and proportioning the phosphate rock. *At bottom.* Front view of bagging and shipping plant as it appeared July 16, 1934.

WHAT AND WHERE ARE

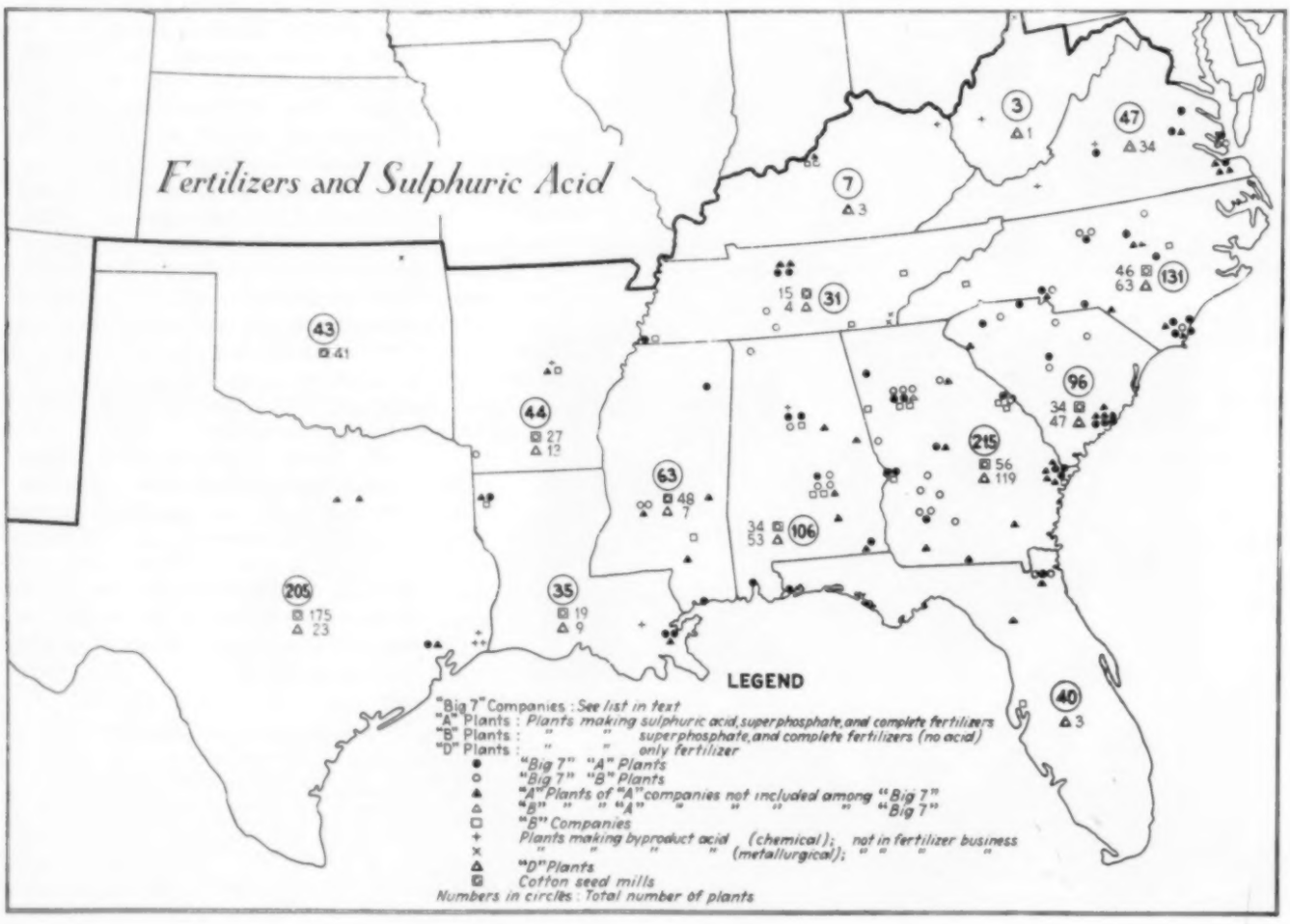
By R. S. McBRIDE

Editorial Representative of Chem. & Met.

PROCESS INDUSTRY in the area south of the Potomac and Ohio Rivers is complicated and diversified as may be expected in a great and varied territory including nearly 30 per cent of the population of the United States. Certain industries are more important than others from the chemical engineer's point of view, notably those based on forest products, petroleum, fertilizers, and certain of the minerals which require chemical processing. These groups deserve attention here.

Fertilizer manufacture in the South is more important than anywhere else in the United States. Nearly three-quarters of the production and use occurs there. And intimately interrelated are sulphuric acid manufacture, sulphur and phosphate rock mining, and the manufacture and use of other important heavy chemicals or fertilizer ingredients such as cottonseed meal.

In the fertilizer industry are seven enterprises which manufacture and market nationally, commonly called the "Big 7." This group is outstanding in the business in much of the Southern territory, as elsewhere. Although only about 20 per cent of the plants are included in this group, these plants do more than half of the business on a tonnage basis. The bulk of capacity is concentrated in about 50 "A" plants making sulphuric acid, superphos-



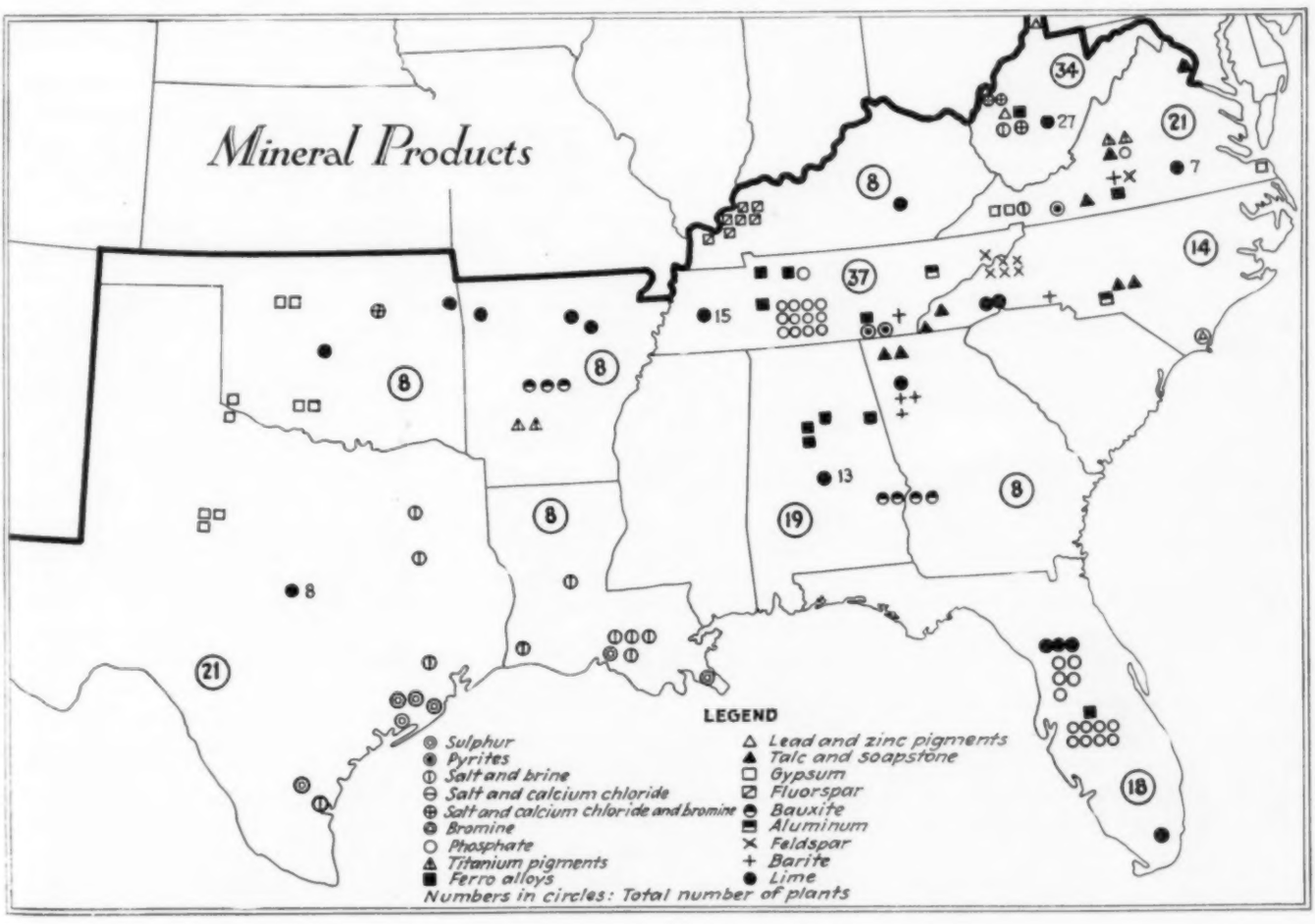
THE PROCESS INDUSTRIES OF THE SOUTH

phate, and mixed fertilizer. A somewhat smaller number of establishments, the "B" plants, are supplied with acid from other works of their own company, or purchase acid from other concerns to make superphosphate and mixed fertilizer. Largest in number but with less than a quarter of the total fertilizer capacity, are the dry mixing establishments, the so-called "D" plants, taking superphosphate and chemicals from other parts of the companies' systems to be mixed for nearby marketing.

Two of these seven companies, Armour and Swift, were originally meat packers; their fertilizer activities are, however, now quite independent. The other five have always been essentially of fertilizer character, but all of them have other chemical activities in addition to fertilizer. And all of these seven companies, as well as many of the smaller regional enterprises, are significant factors in the sulphuric acid industry of the country.

In the territory under consideration there are about 50 plants owned by other companies than the "Big 7" with a complete system including sulphuric acid, superphosphate, and fertilizer; 38 of these include an acid unit. In the territory where they operate, several of these companies are just as important as those of the "Big 7" group.

Twenty other establishments make superphosphate in this territory. These and the few affiliated dry mixing plants constitute the Class "B" companies, as they are



SELECTED LIST OF SOUTHERN PROCESS INDUSTRIES

These lists of certain companies doing business in the South have been compiled with the aid of Government information, trade directories, and many cooperating groups in industry whose assistance is gratefully acknowledged. It is hoped that some inevitable omissions and errors may not militate too much against the usefulness of these lists.—R.S.M.

Fertilizers

"Big Seven"
American Agricultural Chem. Co., New York.
Armour Fertilizer Works, Atlanta, Ga.
Davison Chemical Co., Baltimore, Md.
International Agric. Corp., New York.
F. S. Royster Guano Co., Baltimore, Md.
Swift & Co. Fertilizer Works, Chicago.
Virginia-Carolina Chem. Corp., Richmond, Va.

Other "A" Plants
Acme Mfg. Co., Acme, N. C.
Anderson Fert. Co., Anderson, S. C.
Arkansas Fert. Co., Little Rock, Ark.
Bay Chemical Co., New Orleans, La.
Blackshear Mfg. Co., Blackshear, Ga.
Cotton States Fert. Co., Macon, Ga.
Dixie Guano Co., Laurinburg, N. C.
Empire State Chem. Co., Athens, Ga.
Etiwan Fert. Co., Charleston, S. C.
Farmers' Cotton Oil Co., Wilson, N. C.
Federal Chem. Co., Louisville, Ky.
Georgia Fert. Co., Valdosta, Ga.
Home Guano Co., Dothan, Ala.
Jackson Fert. Co., Jackson, Miss.
Maybank Fert. Co., Charleston, S. C.
Merchants' Fert. & Phos. Co., Charlotte, N. C.
Meridian Fert. Factory, Meridian, Miss.
Mutual Fert. Co., Savannah, Ga.
New Louisville Rendering Co., Louisville, Ky.
Pelham Phosphate Co., Pelham, Ga.
Planters Chem. & Oil Co., Talladega, Ala.
Planters Fert. & Phos. Co., Charleston, S. C.
Reliance Fert. Co., Savannah, Ga.
Richmond Guano Co., Richmond, Va.
Roanoke Guano Co., Roanoke, Ala.
Robertson Chem. Corp., Raleigh, N. C.
Southern Fert. & Chem. Co., Savannah, Ga.
Southern States Phos. & Fert. Co., Savannah, Ga.
Standard Chem. Co., Troy, Ala.
Tennessee Corp., Copper Hill, Tenn.
Texas Chem. Co., Houston, Tex.
United Chem. Co., Dallas, Tex.
Victor Chem. Works, Nashville, Tenn.
Wilson & Toomer Fert. Co., Jacksonville, Fla.

"B" Plants (do not make acid)
A. D. Adair & McCarty Bros., Atlanta, Ga.
Alabama Chem. Co., Montgomery, Ala.
Asheville Packing Co., Asheville, N. C.
Columbus Fert. Corp., Columbus, Ga.
Contentnea Guano Co., Wilson, N. C.
Etheredge Guano Co., Augusta, Ga.
Knoxville Fert. Co., Knoxville, Tenn.
Laurel Oil & Fert. Co., Laurel, Miss.
H. O. Lovvorn Fert. Co., Carrollton, Ga.
Newhouse Chem. & Supply Co., Little Rock, Ark.
G. Ober & Sons Co., Savannah, Ga.
Price Chem. Co., Louisville, Ky.
Redd Chem. & Nitrate Co., Birmingham, Ala.
Seacoast Fert. Co., Augusta, Ga.
Shreveport Fert. Works, Shreveport, La.
Standard Fert. Co., Gainesville, Fla.

Sulphuric Acid

(Not primarily fertilizer plants)
Chemical Companies
E. I. du Pont de Nemours & Co., Mineral Springs, Ala.
Southern Acid & Sulphur Co., No. Little Rock, Ark.
Grasselli Chem. Co., Wurtland, Ky.
Southern Acid & Sulphur Co., Bossier City, La.
Louisiana Chem. Co., Baton Rouge, La.
Ozark Chem. Co., Tulsa, Okla.
Texas Chem. Co., Houston, Tex.
Texas Chem. Co., Fort Worth, Tex.
Gulf Refining Co., Port Arthur, Tex.
Southern Acid & Sulphur Co., Port Arthur, Tex.
United Chem. Co., Dallas, Tex.
General Chemical Co., Pulaski, Va.
Vanadium Corp. of America, Piney River, Va.
Carbide & Carbon Chem. Corp., South Charleston, W. Va.

Metallurgical Companies
National Zinc Co., Bartlesville, Okla.
Ducktown Chem. & Iron Co., Isabella, Tenn.
Tennessee Corp., Copper Hill, Tenn.
United Zinc Smelting Corp., Moundsville, W. Va.

Mineral Products

Sulphur Mines
Duval Texas Sulphur Co., Benavides, Tex.
Freeport Sulphur Co., Lake Grande Ecaille, La.
Freeport Sulphur Co., Freeport, Tex. (2 mines)
Jefferson Lake Oil Co., Lake Peigneur, La.
Texas Gulf Sulphur Co., Gulf, Tex.
Texas Gulf Sulphur Co., Long Point, Tex.
Texas Gulf Sulphur Co., Newgulf, Tex.

Pyrites Producers
Ducktown Chem. & Iron Co., Isabella, Tenn.
General Chem. Co., Cliffview, Va.
Tennessee Copper Co., Copper Hill, Tenn.

Salt and Salt Products
Avery Salt Co., Avery Island, La.
Carey Salt Co., Winnfield, La.
J. Q. Dickinson & Co., Malden, W. Va. (Also Br. and $CaCl_2$)
Ethyl-Dow Chemical Co., Wilmington, N. C. (Br., no salt)
Jefferson Island Salt Mfg. Co., Jefferson Island, La.
Liverpool Salt & Coal Co., Hartford, W. Va. (Also Br. and $CaCl_2$)
Mathieson Alkali Works, Lake Charles, La. (Salt products)
Mathieson Alkali Works, Saltville, Va.
Morton Salt Co., Grand Saline, Tex.
Myles Salt Co., Weeks Island, La.
Ohio River Salt Corp., Mason, W. Va. (Also Br. and $CaCl_2$)
Palestine Salt & Coal Co., Palestine, Tex.
Solvay Process Co., Baton Rouge, La. (Salt products)
Southern Alkali Co., Corpus Christi, Tex. (Salt products)
Texaco Salt Products Co., West Tulsa, Okla. (Also $CaCl_2$)
United Salt Corp., Hockley, Tex.
Westvaco Chlorine Products, So. Charleston, W. Va. (Salt products)

Wood Products

Paper and Pulp
Mobile Paper Mill Co., Crichton, Ala.
Southern Kraft Corp., Mobile, Ala.
Gulf States Paper Co., Tuscaloosa, Ala.
Southern Kraft Corp., Camden, Ark.
Grass Fiber Pulp & Paper Co., Leesburg, Fla.
Armstrong-Newport Co., Pensacola, Fla.
Southern Kraft Corp., Panama City, Fla.
Buckeye Cotton Oil Co., Augusta, Ga.
National Paper Co., Bolton, Ga.
Noble Mfg. Co., Cedartown, Ga.
Atlantic Paper & Pulp Corp., Savannah, Ga.
Research Div. Georgia Dept. of Forestry, Savannah, Ga.
Southern Kraft Corp., Bastrop, La. (2 mills)
Bogalusa Paper Co., Bogalusa, La.
Gulf State Paper Co., Braithwaite, La.
Southern Advance Bag & Paper Co., Hodge, La.
Calcasieu Sulphate Paper Co., Elizabeth, La.
Celotex Co., Marrero, La.
National Pulp, Paper & Cardage Co., Marrero
Alton Box Board & Paper Co., New Iberia, La.
Apex Paper Inc., New Orleans.
Brown Paper Mill Co., West Monroe, La.
Flintkote Corp., New Orleans, La.
U. S. Gypsum Co., Greenville, Miss.
Masonite Corp., Laurel, Miss.
Southern Kraft Corp., Moss Point, Miss.
Champion Fibre Co., Canton, N. C.
Halifax Paper Co., Roanoke Rapids, N. C.
Southern Paper Board Mills, Roanoke Rapids, N. C.
Sonoco Products Co., Rockingham, N. C.
Sylva Paperboard Co., Sylva, N. C.
Carolina Fibre Co., Hartsville, S. C.
Sonoco Products Co., Hartsville, S. C.
O. B. Andrews Co., Chattanooga, Tenn.
Southern Chem. Cotton Co., Chattanooga, Tenn.
Tennessee Paper Mills, Chattanooga, Tenn.
Harriman Co., Harriman, Tenn.
Mead Corp., Kingsport, Tenn.
Southern Extract Co., Knoxville, Tenn.
Buckeye Cotton Oil Co., Memphis, Tenn.
Memphis Cotton Hull Fibre, Memphis, Tenn.
Mead Paperboard Corp., Nashville, Tenn.
Lone Star Paper Mills, Commerce, Tex.
Fleming & Sons, Dallas, Tex.
Commercial Pulp & Paper Co., Orange, Tex.
Bedford Pulp & Paper Co., Big Island, Va.
Columbian Paper Co., Bristol, Va.
Columbian Paper Co., Buena Vista, Va.
Bedford Pulp & Paper Co., Colemans Falls, Va.
W. Va. Pulp & Paper Co., Covington, Va.
Hercules Powder Co., Hopewell, Va.
Hummel-Ross Fibre Corp., Hopewell, Va.
John H. Heald Co., Lynchburg, Va.
Albemarle Paper Mfg. Co., Richmond, Va.
Manchester Board & Paper Co., Richmond, Va.
Standard Paper Mfg. Co., Richmond, Va.
Albemarle-Chesapeake Co., Westpoint, Va.
Chesapeake Corp., Westpoint, Va.
Shenandoah Paper Board Co., Winchester, Va.
Halltown Paper Board Co., Halltown, W. Va.
Shenandoah Pulp Co., Harper's Ferry, W. Va.
Viscose Co., Nitro, W. Va.
Cherry River Paper Co., Richwood, W. Va.
S. George Co., Wellsburg, W. Va.
George & Sherrard Paper Co., Wellsburg, W. Va.
Hammond Bag & Paper Co., Wellsburg, W. Va.
Harvey Paper Mills Co., Wellsburg, W. Va.

Hardwood Distillation
Crossett Chem. Co., Crossett, Ark.
Forest Products Chem. Co., Memphis, Tenn.
Tennessee-Eastman Corp., Kingsport, Tenn.
Tennessee Products Corp., Lyles-Wrigley, Tenn.
Buckhannon Chem. Co., Buckhannon, W. Va.

Chemicals

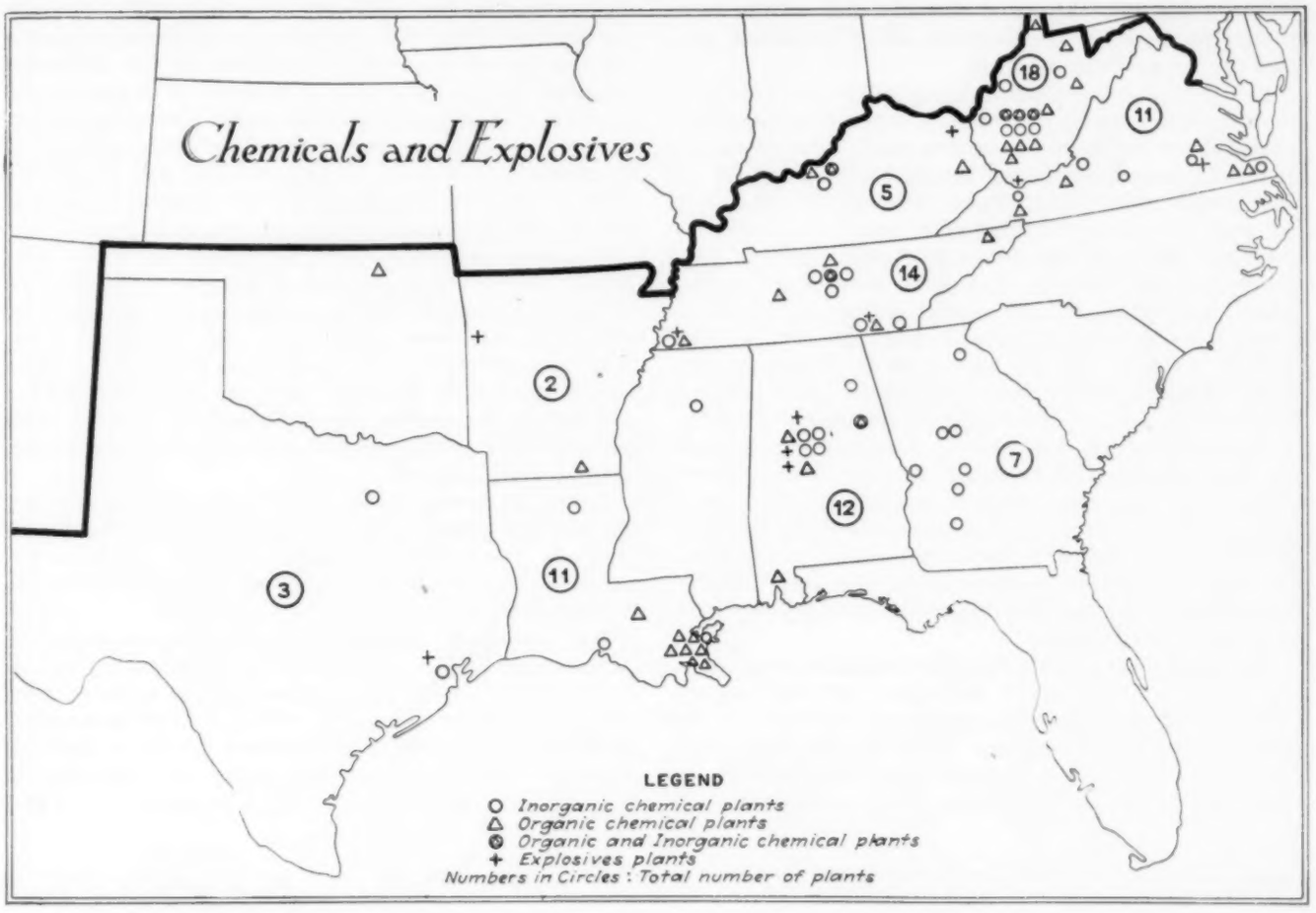
(Establishments making "Chemicals not separately classified by Census of Manufactures" not including dyes, pharmaceuticals, or many other specialties individually reported on by the Census)

Inorganic Chemicals
Swann Corp., Birmingham, Ala.
Swann Corp., Anniston, Ala.
Hercules Powder Co., Bessemer, Ala.
E. I. du Pont de Nemours & Co., Watson, Ala.
Gulf States Steel Co., Alabama City, Ala.
Am. Steel & Wire Co., Fairfield, Ala.
Paper Makers Chem. Corp., East Point, Ga.
J. W. Woolfolk Co., Fort Valley, Ga.
Crystal Carbonic Laboratory, Atlanta, Ga.
Tennessee Chem. Co., Albany, Ga.
Armour Fertilizer Works, Columbus, Ga.
Kentucky Color & Chem. Co., Louisville, Ky.
Tobacco Byproducts Chem. Corp., Louisville, Ky.
Myles Salt Co., Weeks Island, La.
Louisiana Chem. Co., Bastrop, La.
Paper Makers Chem. Co., New Orleans, La.
Victor Chem. Works, Nashville, Tenn.
Kalbfleisch Corp., Chattanooga, Tenn.
Tennessee Products Corp., Nashville, Tenn.
Commercial Chem. Co., Memphis, Tenn.
Read Phosphate Co., Nashville, Tenn.
Tennessee Chemical Co., Nashville, Tenn.
Texas Chem. Co., Houston, Tex.
Texas Chem. Co., Fort Worth, Tex.
Atmospheric Nitrogen Corp., Hopewell, Va.
Mathieson Alkali Wks., Saltville, Va.
E. J. Lavino & Co., Reusens, Va.
Virginia Smelting Co., W. Norfolk, Va.
West Va. Pulp & Paper Co., Covington, Va.
Seydel Chem. Co., Nitro, W. Va.
E. C. Klipstein & Sons Co., Charleston, W. Va.
Barium Reduction Corp., Charleston, W. Va.
J. Q. Dickinson & Co., Malden, W. Va.
Ohio River Salt Corp., Mason, W. Va.
Westvaco Chlorine Products, Inc., Charleston
Union Explosives Co., Clarksburg, W. Va.
Belle Alkali Works, Belle, W. Va.
Cabell Chemical Co., Huntington, W. Va.
E. I. du Pont de Nemours & Co., Belle, W. Va.

Organic Chemicals
American Tar Products Co., Woodward, Ala.
The Barrett Co., Fairfield, Ala.
Republic Creosoting Co., Mobile, Ala.
Swann Corporation, Anniston, Ala.
Crossett Chemical Co., Crossett, Ark.
Union Charcoal & Chem. Co., Kragon, Ky.
Kentucky Color & Chem. Co., Louisville, Ky.
Van Camp Packing Co., Louisville, Ky.
American Comm. Alcohol Co., Gretna, La.
Comm. Solvents Corp., Harvey, La.
Comm. Solvents Corp., Westwego, La.
Comm. Solvents Corp., Braithwaite, La.
U. S. Industrial Alcohol, New Orleans, La.
U. S. Industrial Alcohol, Westwego, La.
Jasco, Inc., Baton Rouge, La.
Nat. Ind. Alcohol Co., New Orleans, La.
Star Oil Processing Co., Bartlesville, Okla.
Tennessee Products Corp., Lyles-Wrigley, Tenn.
Tennessee Products Corp., Nashville, Tenn.
Forest Products Chem. Co., Memphis, Tenn.
Tennessee-Eastman Corp., Kingsport, Tenn.
E. I. du Pont de Nemours & Co., Old Hickory
Reilley Tar & Chemicals Corp., Chattanooga
Stauffer Chem. Co., Roanoke, Va.
Atlantic Creosoting Co., Portsmouth, Va.
Republic Creosoting Co., Norfolk, Va.
Beaver Chem. Corp., Damascus, Va.
Alcatraz Co., Richmond, Va.
Buckhannon Chem. Co., Buckhannon, W. Va.
Carbide & Carbon Chem. Corp., South Charleston, W. Va.
Sutton Chem. Co., Sutton, W. Va.
Westvaco Chlorine Products, Charleston, W. Va.
American Tar Products Co., Follansbee, W. Va.
E. C. Klipstein & Sons Co., S. Charleston, W. Va.
Rubber Service Labs. Co., Nitro, W. Va.
Seydel Chem. Co., Nitro, W. Va.
Belle Alkali Works, Belle, W. Va.
E. I. du Pont de Nemours & Co., Belle, W. Va.
California Chem. Co., Charleston, W. Va.
Reilley Tar & Chem. Co., Fairmont, W. Va.

Explosives

Atlas Powder Co., Ooltewah, Tenn.
E. I. du Pont de Nemours & Co., Mineral Springs, Ala.
E. I. du Pont de Nemours & Co., Connable, Ala.
E. I. du Pont de Nemours & Co., Nemours, W. Va.
Hercules Powder Co., McAdory, Ala.
King Powder Co., Kico, Ky.
Texas Fireworks Co., Dumont, Tex.
U. S. Fireworks Mfg. Co., Memphis, Tenn.
Virginia Fireworks Co., Petersburg, Va.
Equitable Powder Mfg. Co., Fort Smith, Ark.



commonly known in this industry. Although many of these establishments are of good size, none is a factor in the sulphuric acid field as all operate with purchased acid.

And finally, the bulk of the fertilizer industry, measured in number of companies, is made up of small establishments which merely buy superphosphate and other chemicals for dry mixing. Most of these have hardly any close chemical control and do not really deserve the designation "process industry." Space prevents any discussion or further description of that group here. Only the number of establishments, not their location, is shown on the map.

United States production of phosphate rock occurs principally in Florida and Tennessee. Idaho, Montana, and Wyoming contribute together 2 or 3 per cent of the country's supply, while Virginia is also a small intermittent producer. On the minerals map are shown the principal locations where commercial producers mine and prepare phosphate rock for market. Small operators not owning any drying plant which sell their rock to local companies are not included.

The production of Florida land pebble is the outstanding division of the industry, in recent years accounting for about 80 per cent of the total production with Tennessee supplying the bulk of the remainder. Florida hard rock, a poor third, about equals the output of the Western states.

About 90 per cent of the phosphate rock is used in the manufacture of superphosphates by fertilizer companies using the wet process. Of the remainder the bulk is used for furnace and special applications in which ferrophosphorus, phosphoric acid, or industrial chemical phosphates are the end product. Almost negligible tonnages go for direct application to the soil as ground rock, for fertilizer filler, and miscellaneous including stock and poultry feed.

The map shows by appropriate symbol the location of each of the 100 acid plants or fertilizer plants which contain an acid unit. This group of establishments may be classified as follows:

"Big 7" companies' establishments	47
Other fertilizer companies' establishments	38
Non-fertilizer establishments:	
Metallurgical byproduct acid	4
Chemical byproduct acid	11
Total establishments with acid plants	100

It will be noted that in this part of the country the bulk of the sulphuric acid business is directly connected with the fertilizer industry. As a matter of fact, some of the byproduct metallurgical acid made could be so classified, as affiliates of the Tennessee enterprises which are strictly metallurgical, are also engaged in the fertilizer business in nearby states. Considering this byproduct acid used directly in fertilizer work as a part of the fertilizer business, one finds 87 per cent of the plants and probably nearly as high a percentage of the total tonnage of acid directly related to superphosphate and fertilizer business.

Raw material for sulphuric acid making in the South is usually either purchased sulphur or byproduct sulphur oxides from roaster gases. A few works use pyrites either purchased domestically or imported. On the minerals map is shown the location of the seven southern sulphur

mines which have operated recently and of the three pyrites producers in the territory, all of whom use their own ore for acid manufacture.

Salt and salt-brine products are produced extensively in Southern territory by more than a dozen important companies shown on the accompanying map. A large number of small enterprises operate locally for recovery of salt from playas or lagoons to make cattle salt for use locally, but none of these justify treatment here.

Of the salt producers shown four establishments make electrochemical products, Mathieson, Westvaco, Southern Alkali, and Solvay. Four smaller enterprises shown on the map, produce calcium chloride, and three of these make bromine as well. In the aggregate the Southern companies making alkali, chlorine, and other electrochemical products form an important part of the national industry.

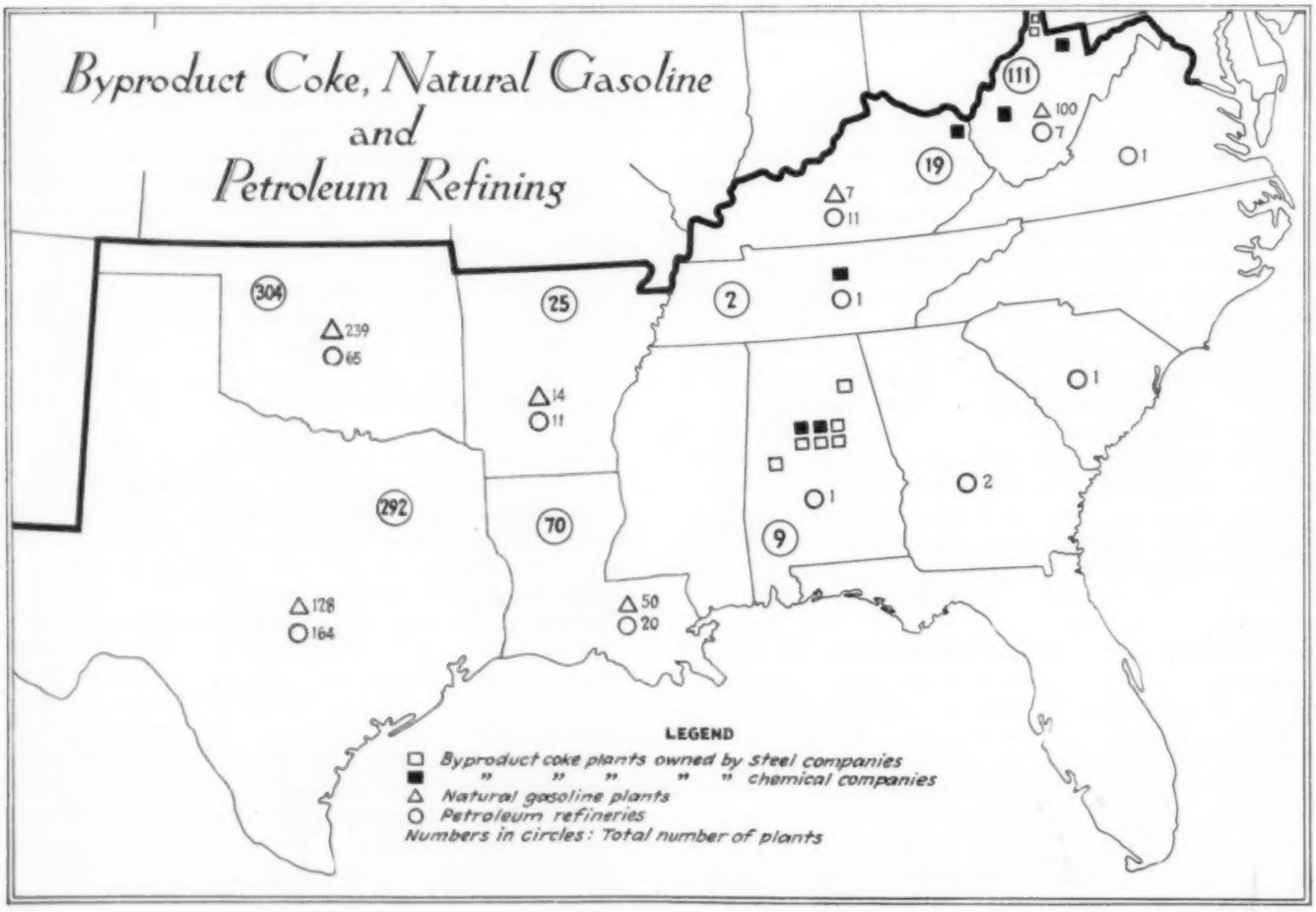
Gypsum products are made in Southern plants which use both domestic and imported mineral. Approximately a dozen of these establishments operate with fair regularity. Several of the establishments are definitely of the gypsum plaster industry, particularly the U. S. Gypsum Co., and Certain-teed Products Corp. Some of the other concerns are connected with the cement business and some have chemical affiliation.

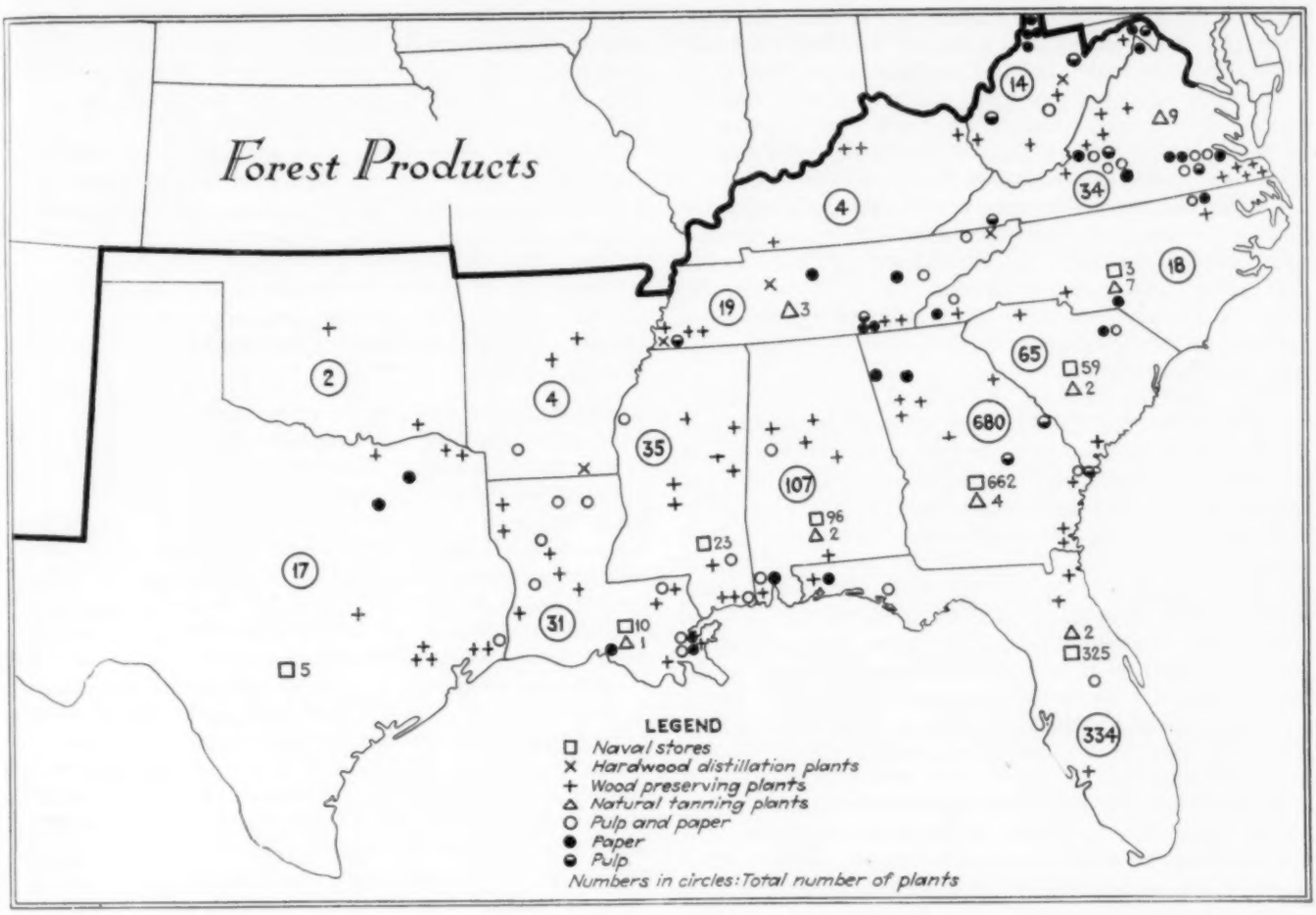
The entire United States bauxite production is in Southern territory, principally in Arkansas with small regular contributions from Georgia and Alabama, and intermittent contributions from Tennessee. Until the last year or two, aluminum making has required more than half of the total domestic bauxite production. But recently chemicals making has become relatively more important; in some periods, notably in 1932, requirements of domestic bauxite for this purpose have exceeded those of the aluminum industry itself. Aluminum Company of America, the producer of virgin pig aluminum in the United States, has four reduction plants, two in New York state, and two in the South, at Baden, N. C., and at Alcoa, near Knoxville, Tenn. The combined capacity of the Southern plants is almost half of the country's total.

Fluorspar is produced in a number of states with Illinois and Kentucky producing together almost the entire country's supply. It is primarily used for steel making, which requires from two-thirds to three-fourths of the total domestic production. Glass uses from 10 to 15 per cent, enamels and vitriolite 4 or 5 per cent, hydrofluoric acid and its derivatives varying quantities from 3 to 10 per cent, with foundry and miscellaneous uses accounting for the small balance.

Barite production in the South centers at Cartersville, Ga., but subordinate points of mineral production are in Virginia, North Carolina, and Tennessee. Only a few establishments are, however, of large chemical engineering significance.

The milling of feldspar in Southern states is limited to operations in North Carolina, Tennessee, and Virginia. A considerable number of small companies operate mines but only a few are engaged in milling or other processing. In addition to the half dozen concerns shown on the map, there are new establishments under consideration at Goodes, Va., and Alarka, N. C. The operations of the





Southern enterprises make up somewhat more than half of the total United States output.

Melting of ferro-alloys in electric furnace and in blast furnace are both practiced in the South, although collectively, Southern furnace operations yield much less than half of the country's total output. Niagara Falls and other Northern power centers being the important locations in this industry.

The South has its share of practically every division of the fuel industry except anthracite. Chemical engineering, however, deals primarily with coke, petroleum refining, and natural gasoline production. The coke industry centers largely in Birmingham, Ala., and Charleston, W. Va., the former associated with the steel industry, and the latter with chemical companies. The beehive coke industry, once dominant, still operates on a modest scale, particularly in West Virginia. However, this industry has so little connection with chemical enterprises that it does not really deserve serious process-industry attention. It is now essentially a reserve of coke-making capacity.

Petroleum refineries are numerous in the South, with 40 per cent of the establishments and nearly the same share of total capacity. Including the smaller enterprises doing largely a local business, there are in the 14 Southern states 283 separate refineries reported by the Bureau of Mines.

Natural gas production has led to other chemical engineering activities, for the recovery and refining of natural gasoline and the liquefiable hydrocarbon gases. Naturally the great sources of gas, Texas, Oklahoma, and West Virginia, are outstanding in number of gasoline recovery units while Arkansas, Kentucky, and Louisiana each have a few. In the aggregate, these six states have nearly 60 per cent of the total of natural-gasoline establishments in the country.

The refining and "stabilizing" of natural gasoline leads to the separation and recovery of large quantities of liquefiable hydrocarbon gases. At present there are 21 companies regularly marketing propane and butane products of this character. All of these except five in California and two in Pennsylvania do a great share of their business in the Southern states. About half of these enterprises are directly affiliated with the petroleum and petroleum-refining industries. *Chem. & Met.* has recently reported a large output of bottled and high-pressure tank gas of this sort which is marketed and no further detail need be given here.

Discussion of fuels in the South, from a chemical-engineering point of view, would be incomplete without reference to the very generous supply of electric power available in this territory. In some of the states, notably those affected by T.V.A., this power is available for industry at unusually low rates. However, there is no evidence that thus far the development of power has significantly cut in on the business of fuel processing. Rather has there been a mutually stimulating influence. In many cases electrical energy for its successful application in chemical processes depends on fuel as a process reagent or as an auxiliary heating medium.

The chemical industries are large users of forest prod-

ucts for the manufacture of pulp, paper, charcoal, wood chemicals, naval stores, and a variety of other materials. Most important to the chemical engineer in Southern territory are the pulp and paper and the hardwood distillation groups of industries. The pulp and paper group promises to become even more important if the developments of some new softwood utilization processes materialize.

On the accompanying map are shown the geographic location of these principal process-industry establishments using wood as raw material. Supplementing the hardwood distillation group are numerous softwood distillation plants. The number of these in each state is indicated but not the location because of the transient and irregular nature of that industry.

The production of naval stores is, of course, a typically Southern industry. Over a thousand establishments ordinarily operate for turpentine and rosin, nearly 90 per cent of them in Georgia and Florida alone. Many of these are, of course, of a local and primitive nature. Only a few use modern chemical engineering equipment, but all supply products of importance to the process industries.

Of interest principally as a user of chemicals in the wood products business is the group of companies which do wood preserving. Necessarily located where cheap timber is available, many of these establishments are found in the South. Most of these establishments use creosote as the treating material and the proportion of timber treated here with zinc chloride or other salts is rather smaller than in Western territory.

Manufacture of chemicals not connected with either fertilizers or forest products is not as common in Southern territory as elsewhere in the United States. This point is well illustrated by the fact that only 60 out of about 550 establishments of this character, as classified by the Census of Manufactures, are in these 14 states.

Organic chemicals made in this territory are frequently produced in industrial operations with some other primary objective. For example, acetic acid and calcium acetate are manufactured in Tennessee by three important wood chemicals concerns, the primary output of which is charcoal. A striking exception to the general rule in the South is furnished by Charleston, W. Va., an important manufacturing center where synthetic organics, chlorinated hydrocarbons, and a variety of other products are produced. This locality also accounts for the only synthetic ethyl alcohol and one of the two largest synthetic methanol plants of the country.

Quite a number of coal tar products are produced in the tar refineries in the South; but they, according to Census classification, are not included in the group of miscellaneous chemicals. As a matter of fact they are economically a natural associate of the fuel-processing industry, both in the South and elsewhere. Dyes, pharmaceuticals, and many other chemical products are likewise classified as other industries by the Census.

Aside from the sulphuric acid industry affiliated with the fertilizer business, the manufacture of inorganic chemicals in the South is largely that relating to specialties. Hydrochloric acid, nitric acid, salt cake, and other salt products all find their chemical affiliations in the naturally associated business activities. Some tie in directly with caustic, chlorine and soda ash, some with explosives, but others have more nearly the "merchant" chemical character. But with the exception of salt products, which in prospect is very important in the South, the northern branches of the industry are larger and usually dominant in the country's trade as a whole. Perhaps only in the field of arsenicals and other insecticides does the South assume greatest importance for the general group of inorganic products.

Because of natural economic advantages, process industry finds generous representation in the South for sugar refining, cottonseed processing, and rayon manufacture.

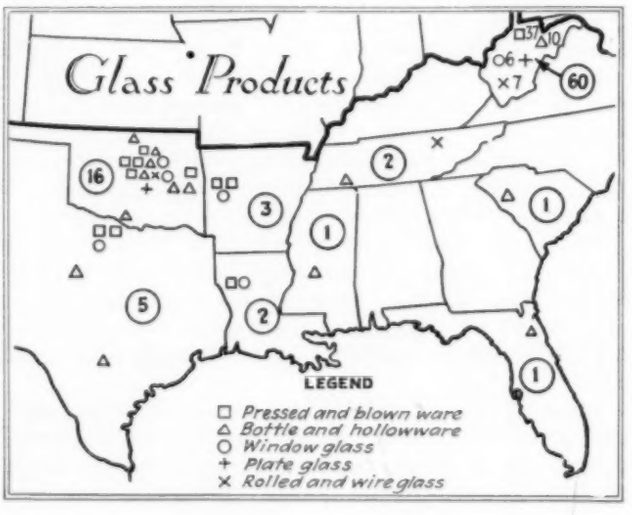
The following 7 sugar refineries with a daily aggregate capacity of almost 14,000,000 lb. represent nearly a quarter of the total melting capacity of the United States. ("Manual of Sugar Companies," 1933. Farr & Co., New York.)

	Pounds
American Sugar Refining Co., Chalmette, La.	4,000,000
Savannah Sugar Refining Corp., Savannah, Ga.	2,500,000
Godchaux Sugars, Inc., Reserve, La.	2,000,000
Colonial Sugars Co., Gramercy, La.	1,350,000
Imperial Sugar Co., Sugar Land, Tex.	1,600,000
Texas Sugar Refining Co., Texas City, Tex.	1,500,000
Henderson Sugar Refining Co., New Orleans	750,000

Cane sugar production, of course, finds its chief continental representatives in America within Louisiana where about 70 establishments operate.

Cottonseed crushing is carried out almost exclusively in this territory. About 450 mills with nearly 3,000 presses represent the whole industry of the country. With the constant movement of cotton acreage westward has come a dominance in cottonseed oil and cottonseed meal on the part of the states west of the Mississippi. More than half of the total number of mills and a like percentage of the presses are found in these four Southwestern states. The production of the eastern part of the South is, however, well maintained and still an extremely important part of the cottonseed industry.

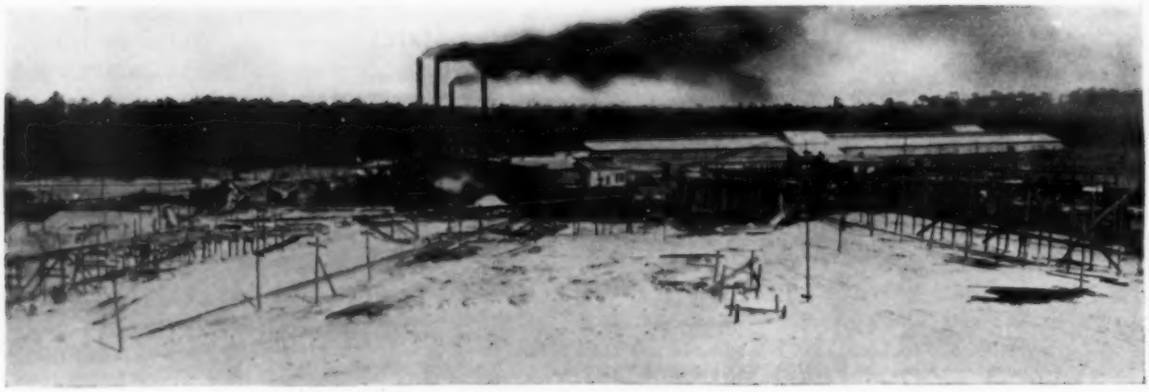
For a variety of reasons, development of rayon production has been most important in the South in recent years. There are in this territory now 12 out of approximately 30 concerns making rayon. *Chem. & Met.* has already presented a discussion of this subject in its pages so that here it is not necessary to repeat a description of the names, locations, and types of rayon produced. (See *Chem. & Met.*, Aug. 1933, p. 421.)



Glass Plants in the Southern States

(After "Glass Factory Directory," Budget Publishing Co., Pittsburgh, Pa.)

Location	Name of Firm	Equipment	Products Manufactured
Arkansas			
Fort Smith	Radiant Glass Co.	3 cont. tanks	Lamp chimneys, lantern globes, gas globes, 5-gal. bottles.
	Witherspoon-Simpson Glass Co.	1 cont. tank	Lamp chimneys, lantern globes, bottles, minnow traps.
	Harding Glass Co.	2 tanks, 11 Fourcaults	Window glass and heavy sheet specialties.
Florida			
Jacksonville	Florida Glass Mfg. Co.	1 cont. tank, 3 machines	Flasks, milks, packers' ware, sodas, prescriptions, ginger ales.
Louisiana			
Shreveport	Libbey-Owens-Ford Glass Co.	4 furnaces, 7 Libbey-Owens	Window glass.
	Shreveport Lamp Chimney Co.	2 day tanks	Lamp chimneys, gas globes, lantern globes, water bottles, and specialties.
Mississippi			
Jackson	Knox Glass Bottle Co.	1 cont. tank, 4 machines	Bottles.
Oklahoma			
Ada	Hazel-Atlas Glass Co. of Okla.	1 cont. tank	Packers and preservers.
Blackwell	Hazel-Atlas Glass Co. of Okla.	1 cont. tank	Bottles, jars, and packers' ware.
Henryetta	Pittsburgh Plate Glass Co.	2 tanks, 8 sheet machines	Plate glass.
Muskogee	DeCamp Cons. Glass Casket Co.	1 145-ton tank, 2 lehrs	Glass burial caskets.
Okmulgee	Baker Bros. Glass Co.	4 cylinder machines	Window glass.
	Ball Brothers Co.	2 furnaces	Fruit jars, jelly glasses, tumblers, wide-mouth jars, bottles.
	Owen-Illinois Glass Co.	1 furnace, 3 machines	Bottles
	Southwestern Sheet Glass Co.	1 cont. tank, 1 day tank	Rolled glass, ribbed, figured and wire glass; rough and polished glass.
Poteau	Geo. F. Collins & Co.	1 cont. tank	Flint bottles.
	Hyatt Glass Co., Inc.	Not listed	Glass cylinders, water bottles.
Sand Springs	Alexander H. Kerr & Co.	2 cont. tanks	Fruit jars, packers, jellies, metal caps.
	Kerr, Hubbard & Kelly	1 cont. tank	Lamp chimneys, globes; machine and hand.
Sapulpa	Ball Brothers Co.	1 furnace	Fruit jars, jelly glasses, tumblers, wide-mouth jars, bottles.
	Bartlett-Collins Co.	2 cont. tanks, 2 day tanks	Machine and hand pressed and blown table ware; crystal and colors
	Liberty Glass Co.	2 cont. tanks	High-grade milk bottles only.
	Victory Window Glass Co.	4 machines	Window glass.
So. Carolina			
Laurens	Laurens Glass Works	2 cont. tanks, 4 Lynch machines	Flint and light green beers, soda, minerals.
Tennessee			
Chattanooga	Chattanooga Glass Co.	3 cont. tanks	Beers, patent, proprietary, sodas in flint, green. Machine made.
Kingsport	Blue Ridge Glass Corp.	2 cont. tanks	Rough ribbed figured glass; wire glass, polished wire glass.
Texas			
Santa Ana	Texas Glass Co.	1 cont. tank, 1 day tank, 1 furnace	Flint milk bottles, vinegar bottles, packers' jars.
Three Rivers	Three Rivers Glass Co.	Not listed	Bottles and hollow ware.
Wichita Falls	A. W. Ayers Glass Fruit & Novelties Works	Not listed	Glass fruit, wigs, ships, cat-tails, and other novelties, using all colors of imported and domestic tubing and cane.
	Ball Brothers Co.	1 furnace	Fruit jars, jelly glasses, tumblers, wide-mouth jars and bottles.
	Wichita Falls Window Glass Co.	1 tank, 6 machines	Fourcault sheet glass.
West Virginia			
Bridgeport	Bridgeport Lamp Chimney Co.	3 day tanks	Lamp chimneys, gas and lantern globes.
Cameron	Cam-Bell Glass Co.	Not listed	Stemware.
	Cameron Glass & Mfg. Co.	1 cont. tank	Lamp chimneys, lantern and gas globes, small gas and electric shades.
Charleston	Libbey-Owens-Ford Glass Co.	18 Colburns, 12 tanks	Window glass.
	Owens-Illinois Glass Co.	5 furnaces, 10 machines	Bottles.
Clarksburg	Adamston Flat Glass Co.	2 tanks, 12 Fourcaults	Flat glass.
	Akro Agate Co.	5 day tanks, 6 automatic feeders, 6 special machines	Colored, opal and crystal toy marbles, toy tea sets, akrolith plate and graining balls and glass ball.
	Eagle Convex Glass Sp. Co.	3 bending furnaces	Bent glass, convex glass and mirrors, ground and chipped glass.
	Flat Glass Specialty Co.	4 sheet-drawing units; 2 decorating lehrs; edging and grinding.	Colored glass specialties, decorating, edging, etc.
	Hazel-Atlas Glass Company	5 furnaces	Tumblers, jellies, pressed ware, tableware, etc., bottles.
	Master Marble Co.	5 day tanks, 4 machines	Glass marbles and glass balls.
	Owens-Illinois Glass Co.	3 furnaces, 6 machines	Bottles.
	Pittsburgh Plate Glass Co.	2 cont. tanks, 8 plate machines	Plate glass and window glass.
	Rolland Glass Co.	1 tank, 1 furnace, 12 Fourcaults	Window Glass.
Dunbar	Dunbar Glass Corp.	3 cont. tanks	Pressed and blown vases, tumblers, novelties, bottles, stemware.
	Dunbar Hand Blown Glass Wks.	Not given	Lamp chimneys.
Fairmont	Commercial Glass Co.	Not given	Pressed opal jars and novelties.
	Monongah Div. of Gen. Glass	3 cont. tanks	Bottles, jars, packers' ware.
	Owens-Illinois Glass Co.	6 furnaces, 12 machines	Bottles.
Follansbee	Jefferson Glass Co.	1 furnace, 16 pots, 4 day tanks	All types illuminating glass ware, lenses, specialties from private molds.
Grafton	Hazel-Atlas Glass Co.	2 cont. tanks	Bottles, jars, tumblers, jellies, table ware.
Huntington	American Thermos Bottle Co.	1 cont. tank	Thermos bottles.
	Ball Brothers Co.	2 furnaces	Fruit jars, jelly glasses, tumblers, wide-mouth jars and bottles.
	Bischoff Sons & Co.	1 cont. tank, 4 rings, 3 day tanks	Lamp chimneys, lantern globes, gas and electric globes, shades, novelties.
	Alexander H. Kerr & Co.	1 cont. tank	Fruit jars, packers, jellies, metal caps.
	Owens-Illinois Glass Co.	5 furnaces, 19 machines	Bottles.
	Sinclair Glass Co.	5 day tanks, 1 pot furnace	Lenses, novelties, private mold specialties, vigil light tumblers.
Lumberport	Pedersen Glass Co.	1 cont. tank	Industrial specialties, large containers, cylinders for gasoline pumps.
Mannington	Homewood Glass Co.	1 tank, 6 Fourcaults	Window glass.
	Mannington Art Glass Works Co.	1 furnace, 2 pots	Opal glass nest eggs.
Milton	Blenko Glass Co.	1 day tank, 2 furnaces	Colored sheet antique and specialties.
Morgantown	The Beaumont Co.	2 furnaces, 26 pots	Globes, electrical goods and stationers' glass.
	Mississippi Glass Co.	11 cont. tanks, 3 day tanks	Rough, ribbed, figured, wire glass, polished wire glass, cathedral glass.
	Morgantown Glass Works	1 furnace, 18 pots, 3 day tanks,	Lead and lime glass, blown tumblers, stemware, etc.,
	Seneca Glass Works	1 furnace, 14 pots, 1 cont. tank	Tumblers, stemware, cut glass, etc., plain, engraved, cut.
Moundsville	Fostoria Glass Co.	5 furnaces, 76 pots	Table ware, tumblers, goblets, stemware, cut glass, needle and plate etched blown ware, crystal and colored ware, fire colored.
New Martinsville	N. Martinsville Glass Mfg. Co.	2 furnaces, 22 pots	Tableware, tumblers, goblets, globes, stemware, cut ware.
Paden City	American Glass Works	2 cont. tanks	Prescription, proprietary, etc.
	Paden City Glass Mfg. Co.	1 furnace, 14 pots, 2 day tanks	Tableware, jellies, tumblers, stemware, cut glass, opal ware.
	Paul Wissmach Glass Co., Inc.	1 furnace, 5 day tanks, 1 cont. tank	Wire, ornamental, opalescent, double rolled, single rolled, seedy, marine antique, hammered cathedral. Moss and rippled. Special cast.
	Wissmach Raised Glass Co., Inc.	Not given	Raised opal letters for signs, raised glass specialties.
Parkersburg	Universal Glass Products Co.	3 cont. tanks	Milk bottles, jars.
	The Vitrolite Co.	1 cont. tank, 4 day tanks	Vitrolite.
Sabraton	Pressed Prism Plate Glass Co.	1 cont. tank, 36 tons	Prism plate and ornamental glass, port light glass, rough plate.
Salem	Thos. McBride Glass Works.	6 day tanks	Lamp chimneys, pressed and blown glassware in crystal and colors.
Scott Depot	Scott Depot Glass Co.	1 furnace, 1 day tank	Lamp chimneys and gas globes.
Sistersville	Lawrence Glass Novelty Co.	Not given	Glass marbles.
	Scohy Sheet Glass Co.	7 Fourcaults	Window glass.
Star City	Monongahela Valley Gl. Mfg. Co.	2 day tanks	Lamp chimneys, lantern globes, novelty glass ware.
	Perfection Glass Co.	7 day tanks	Opal illuminating glassware.
St. Albans	St. Albans Glass Co.	Not given	Lamp chimneys.
St. Marys	Paramount Glass Co.	6 day tanks	Hand blown stemware and tumblers in crystal and colored glass.
Van Voorhis	Quality Glass Co.	3 day tanks	Opal shades, balls, globes etc., crystal bottom units.
Wellsburg	Crescent Glass Co.	2 cont. tanks, 6 day tanks	Ruby lantern globes, lenses, vigil glasses, lighting goods, novelties.
	Erskine Glass & Mfg. Co.	3 day tanks, 1 cont. tank	Illuminating glass ware, ruby lantern globes, lamps and specialties.
Weston	Louie Glass Co.	5 cont. tanks	Blown tumblers, stemware, vases, jugs, etc.
	Westite Co.	7 day tanks	Colored opal glass.
	W. Virginia Glass Specialty Co.	5 cont. tanks	Stemware, tumblers and jugs in crystal.
Wheeling	Central Glass Works	3 furnaces, 36 pots	Cut, etched, and decorated tableware and crystal.
	Hazel-Atlas Glass Co.	Not given	Tumblers, jellies, pressed ware, tableware, etc.; bottles.
Williamstown	Fenton Art Glass Co.	2 furnaces, 18 pots	Pressed and blown glassware for home decoration and service.



Kaolin deposit and washing plant, Edgar Kaolin Co., Edgar, Fla.

SOUTHERN RAW MATERIALS BECKON CERAMIC INDUSTRY

By A. F. GREAVES-WALKER
Professor of Ceramic Engineering
Raleigh Unit, University of North Carolina
Raleigh, N. C.

IT WAS not until after the World War that the South began to awaken to the value and extent of its vast reserves of non-metallic minerals, most of which are classified as ceramic raw materials.

Previous to the War high-grade bauxite had been mined in Arkansas, some fire clays and diaspor in Missouri, glass sand and gypsum in Oklahoma, fire clay and bauxite in Alabama, kaolin in Georgia, Florida, North and South Carolina, feldspar in North Carolina, glass sand in West Virginia and fullers earth and marble in Georgia, but on the whole the total value of the entire production of these minerals did not attract attention.

Unquestionably it was the War that opened the eyes of Southerners to the wealth that was hidden in their mountains and under their cotton fields. The intensive search for materials necessary for war purposes, carried on by government and state agencies, had produced surprising results. But the South as a whole was still agricultural. It had no money for investment and had to turn to the investment markets of the North.

Realizing that some agency not then in existence was necessary to investigate, develop and present these resources in order to attract capital, departments of Ceramic Engineering were established at state institutions in North Carolina and Georgia and later on in Missouri, Alabama, Virginia, West Virginia and Oklahoma. It was with the establishment of the departments in North Carolina and Georgia, in 1923, that real development of the ceramic industries began in the South. This development, it will be noted, coincided with the industrial expansion that took place throughout the country.

Within a few years North Carolina, which had theretofore produced a small tonnage of kaolin and crude feldspar, became the largest producer of processed feldspar in the country, with mills that were the most modern to be found anywhere in the world. Kaolin improved in quality and increased in tonnage, as did mica. Some of the finest blue, pink and white marbles to be found anywhere were developed, as were also some granites that have gained wide fame. A little known talc mineral, pyrophyllite, also became the basis of several industries.

Georgia became a large producer of refractory and soft kaolins which were used in whitewares, refractories and as rubber and textile fillers. Georgia fullers earth and marble also became prominent. South Carolina and Florida came to the front as producers of soft kaolin for whitewares and paper fillers. Alabama increased her production of refractories. Mississippi developed some of the country's finest ball clays. Oklahoma increased production of glass sand and gypsum. Arkansas increased production of bauxite, as did Missouri, and refractories, especially the high alumina type made from diaspor.

Glass sand developments reached a peak in West Virginia and refractories and ball clay production in-

creased in Kentucky and ball clay production in Tennessee.

All over the South the structural products industries, those making brick, sewer pipe, hollow tile, roofing and quarry tile, sprang up until within a short time this region ceased to be an importer of these products and actually began to ship them into other parts of the country. The manufacture of portland cement also became a leading industry in many parts of the South and new plants were erected in many states.

Overexpansion was inevitable during this period, as elsewhere in the country, and with the advent of the depression in 1929 there was almost a complete stoppage of production in most lines. Fortunately, this did not occur until after development had proceeded to a point where it was definitely determined that within this area, bounded by the Potomac, Ohio and Mississippi rivers, the Gulf and the South Atlantic, there existed the largest reserves of high-grade ceramic raw materials to be found in any area of comparable extent in the world.

In spite of the conditions that have existed during the past four years, research on, and development of, these resources has continued. Missouri has come to the front as a producer of refractories that in quality rank at the top. Georgia has done likewise with the new kaolin refractories.

Alabama has been quietly investigating and learning more about its ceramic minerals. The same is true of Virginia. In both of these states intensive research has been going on and data are being accumulated that will bring rapid development along ceramic lines when investment money becomes easier.

Naturally, Tennessee is being thoroughly investigated in connection with the T.V.A. and while it is the metallic minerals that appear to have attracted the attention of the investigators, the non-metallics seem to offer the greatest promise of future development. Tennessee, like North Carolina, contains a little of everything in the mineral line, but surveys show that the shale deposits are not excelled in extent, beauty of color and wide usefulness, by any in the United States. Large deposits of the best of cement materials, glass sand and phosphate rock are also available, as are smaller deposits of many other ceramic materials.

Mississippi has developed large reserves of bauxite, running about 50 per cent alumina, which will serve as an excellent refractory material.

The outstanding developments during this period have occurred in North Carolina. Cyanite, an aluminum silicate belonging to the sillimanite group, and occurring throughout a wide area in the schists in the western part of the state, has been developed to the point where it has definitely found a market which is constantly growing. This mineral is a refractory with a high fusion point. It is also finding use in electrical porcelains for increasing mechanical and dielectric strength. The separation of this mineral from the schist is accomplished entirely by means of the newly developed induction separator.

Another ceramic material, Cornwall stone, has been developed and placed on the market within the past year by the feldspar producers of North Carolina. This material, used principally by the manufacturers of floor and wall tile, has been imported from England in large quantities for years past. The North Carolina product appears to replace the English without difficulty.

Another new product, potter's flint, *i.e.*, ground quartz used in white ware bodies, has gone into production during the past year.

With these new products and the kaolin and feldspar already in production, North Carolina now produces all the materials required in the large white-wares industries except ball clay and soft kaolin which are present in immense quantities in neighboring Tennessee, Georgia and South Carolina.

Another mineral, olivine, large deposits of which are found in North Carolina, has recently attracted much attention. While the research on this mineral, mag-

Above: Wray olivine quarry, Tennessee Mineral Products Corp., Spruce Pine, N. C.
Right: Kentucky ball clay mine, Kentucky Tennessee Clay Co., Mayfield, Ky.

nesium silicate, is not yet completed, it gives great promise of replacing, to some extent if not entirely, the magnesite now used in such quantities in the steel industry. It has a high fusion point, is basic and does not require "dead burning" before use as does magnesite.

This article would hardly be complete without some reference to the T.V.A. program and its probable effect on the development of the ceramic materials within the influence of its power lines.

The string of main power dams, Wilson, Wheeler and Norris, already built or planned, bisects an area that for ceramic minerals, as regards quality, quantity and variety, cannot be equaled in any similar area in the United States.

Within this area, or so close to it that it amounts to the same thing, are deposits of kaolin, both primary and secondary; feldspar, both potash and soda; ball clay, flint, glass sand, olivine, bauxite, cyanite, fire clay, vermicullite, short-fiber asbestos, magnesium talc, pyrophyllite, mica, limestone, Cornwall stone, marble, granite, baukite (a refractory sandstone), and unlimited quantities of the finest shales that exist anywhere. Most of these minerals occur in large deposits and all of them in commercial quantities. They are located principally in North Carolina, Tennessee, Georgia, Alabama and Virginia. Large and important deposits of some of these minerals also occur in Mississippi, Kentucky, West Virginia and South Carolina, which will no doubt benefit from the cheap power.

Considering the fact that a "pool" of about 2,000,000 hp. will eventually be available in the area and that this tremendous quantity of power must be disposed of, it can hardly be doubted that development of these valuable mineral resources will take place. The location is perfect for the distribution of products. To the south are the Gulf States, to the west the states of the Mississippi Valley, to the north the great industrial states bordering the lakes, and to the east the South Atlantic states and their developing seaports.

An ideal opportunity is offered for the development of the Administration's plan to decentralize industry. Under government direction new industries can be so located as to avoid, in the future, the difficulties encountered in densely populated industrial areas during periods of depression.

Ceramic products require heat in their processing and the cost of fuel is usually a major item. In this country there has been little effort to use electric power in the firing of ceramic products because of its cost.

In Europe, with power costing 5 mills per kw.-hr., car tunnel or continuous kilns have been successfully operating for some time past on both light and heavy products, showing a saving compared to present costs with other fuels in this country. In the Tennessee Valley area, power in quantities can be purchased for as low as 2 to 4 mills per kw.-hr. and the development in this country of kilns to use it, which is entirely feasible, would seem to make it imperative that some ceramic industries, at least, move into the area. The situation confronting the industries is very similar to that which forced the textile mills to move from New England to the Carolinas some years ago.

Experimental work on electrically heated glass tanks has also proceeded far enough to demonstrate that these furnaces can be successfully operated. At the power rates established by the T.V.A., not only could a saving be made on fuel costs, even where natural gas is available, but the size of the tanks could be reduced with an increase of production.

For those processes where flame-producing fuels are necessary, there is an unlimited supply of good coal within the boundries of the area and Louisiana natural gas has already been piped to the border of the area in Georgia.

To summarize, there has been no slowing up in the development of the ceramic industries in the South although the depression has greatly reduced production. With the T.V.A. program rapidly developing, the outlook for expansion of some of the older industries and the starting of many new ones is extremely bright. Thoughtful observers are convinced that the low-priced power will so revolutionize many of the ceramic processes that a relocation of many industries will be an absolute necessity. The change will be gradual but the forecast made years ago by those who know the South's ceramic resources, that it would eventually become the ceramic center of the United States, appears to be more certain of fulfillment than ever before.

▼ ▼ ▼

GAS FIELDS OF TEXAS GULF COAST PROMISE HUGE RESERVES

By HARRY PENNINGTON
Engineer, San Antonio, Tex.

LIKE other basic commodities, natural gas depends for its value upon proximity to industry. Although it was first discovered on the Gulf Coast at White Point, near tidewater at Corpus Christi, some 20 years ago, utilization did not begin until 8 years ago when trunk natural gas pipe lines were constructed from southwestern Texas, along the coast to the Houston Industrial District, which includes the sulphur-producing industry near by.

Where this industrial district consumed some 40 to 50 thousand barrels of fuel oil daily in furnaces beneath boilers and refinery stills and in cement kilns, natural gas, owing to its lower cost, has almost entirely replaced fuel oil.

The bulk of southwestern Texas natural gas moves eastward along the Gulf Coast, to, and past the ports of Corpus Christi, Freeport Harbor, Houston Ship Channel, Beaumont and Port Arthur, making these ports ideally situated with respect to fuel, raw materials, tidewater and rail transportation. Although there are vast

natural gas fields in northwestern and western Texas, such gas moves northward, and there are no trunk lines southward.

Natural Gas Reserves

Those natural gas fields tributary to, and connected by pipe line with, Corpus Christi, Freeport Harbor and Houston include: Bruni-Cole, Kohler, Saxet, Edna, Refugio, Agua Dulce, Sandia, Mathis and Lucas, as shown on the map reproduced herewith. Other fields are McFaddin, Nursery, Van Vleck and Coyle-Concord, which are not entirely defined as to the productive area and reserves of gas, while Pledger Dome, the nearest large gas field to Houston, has been defined to show enormous reserves at high pressure. The latter field shows a natural gas sand reservoir at 6,800 ft.; thickness of sand reservoir, 150 ft.; well mouth pressure 2,750 lb.; total daily open flow capacity from wells completed, approximately 1,200,000,000 cu.ft.; and reserves of about 50,000,000 cu.ft. per day for 30 to 40 years.

Raccoon Bend, Tomball, Conroe, Mykawa and Louise are oil fields which produce quantities of gas with the oil. These are not to be included as reliable gas reserves, for reasons to be discussed below.

In addition to the vast reserves of natural gas mentioned above, there are areas along the Gulf Coast, yet undrilled, which are as large as kingdoms; the reserves developed will without question be materially increased with the years, for wells are being drilled to greater and greater depths, with discoveries of new supplies of large quantity.

Conservation

Consumers of natural gas in Texas find certain assurance of continuity of supply in the strict, penal, police-power statutes which have been enacted, enforceable by state authority against the waste of natural gas from gas fields. No gas from a gas field may be withdrawn, save as needed for light, heat or power. One exception only is made in the law—in the Panhandle Field near Amarillo.

As to gas produced with oil, however, a different situation exists. Assertion of directed control over the energy contained in natural gas found associated with oil is required by law, fixed by regulatory state authority, for the value of the energy of gas, toward producing oil, is greater than the value of the gas itself. And as the quantity of gas, thus limited to each barrel of oil, is measured by the oil produced from a well, and as proration to consumer demand is being attempted with definite results, a supply of natural gas from oil wells cannot be depended upon for continuity.

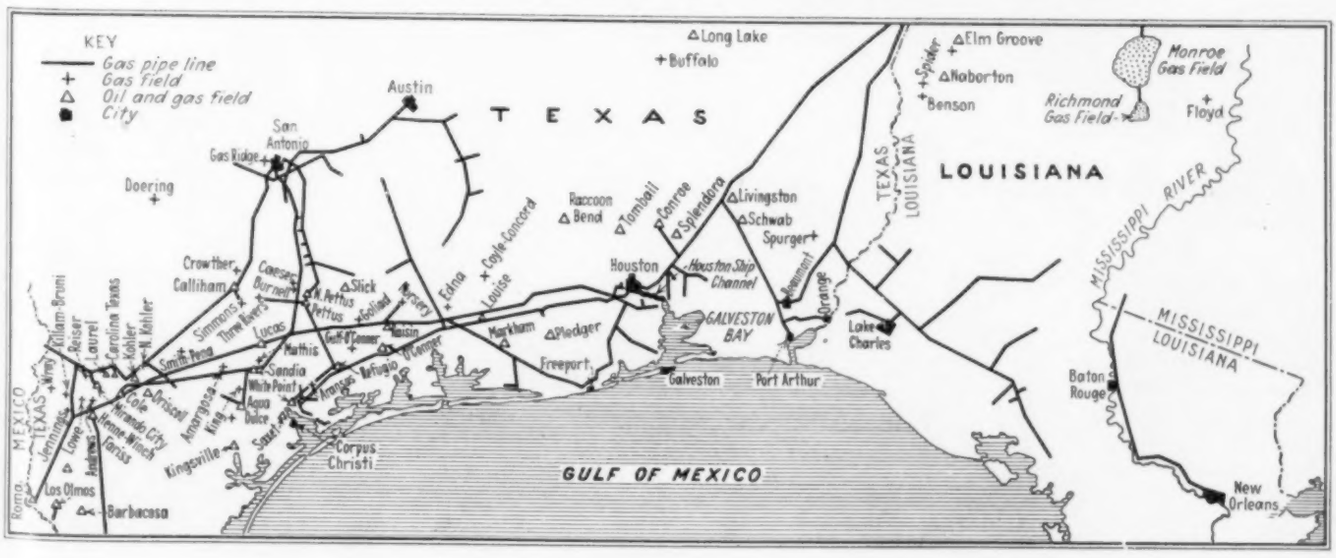
Gulf Coast natural gas ranges around 1,000 B.t.u. per cu.ft. and contracts are usually being based upon this figure, with allowance for higher or lower heat content. While some of the gas from certain oil sands contains sulphur compounds, the natural gas from gas fields is sweet and free of deleterious admixtures.

Gas Transportation

On a heat-unit basis, there is no cheaper means of transporting fuel than by pipe line—tankship excepted. Natural gas, compressed by natural forces and accumulated below ground in sand reservoirs, is endowed with huge amounts of energy, and that energy serves to transport the gas relatively long distances without the use of compressors. From the fields of southwestern Texas, one compression only is required to deliver natural gas at Houston, a distance of 200 or so miles, and where natural gas is found nearer, as at Pledger Dome, 32 miles from Freeport Harbor and 56 miles from the Houston Ship Channel, the high existing reservoir pressure not only eliminates mechanical aid in transportation, but also permits the use of a high-pressure pipe line, further reducing the cost of transportation. Some 75 per cent of Pledger natural gas will be delivered to consumers without compression costs, but only with fixed charges upon a relatively small pipe line.

The construction cost of pipe lines reaches a minimum along the Texas Gulf Coast. The terrain is level on the Gulf Coastal Plain and the ground surface, composed of sedimentary formations, is easily trenched by

Texas Gulf Coast natural gas pipe lines, gas fields and oil and gas fields (After "The Oil Weekly")



machine. Where pipe lines are adequately protected against corrosion by coatings of bitumen and bituminous felt, a useful life of 25 years or more may be secured at initial line pressure.

Depending upon quantity, and upon well-mouth pressure, the cost of transporting natural gas ranges from 4 to 6 mills per 50 miles without compression; and with compression, from 7 to 10 mills additional per M cu.ft.

Several years ago, natural gas took its value from the selling price of fuel oil, on an equivalent heat-unit basis. Today, however, the price of natural gas is far lower, relatively, than fuel oil, and lower than coal. Fuel oil is currently quoted at $1.20 per barrel, Gulf Coast ports, while natural gas may be acquired, under long-time contract, at a fixed delivered price of 8 to 10 cents per M cu.ft., depending somewhat upon quantity, load factor and transportation cost. Natural gas will not lower in price materially, for the above figures approach the cost of production and transportation to the consumer.

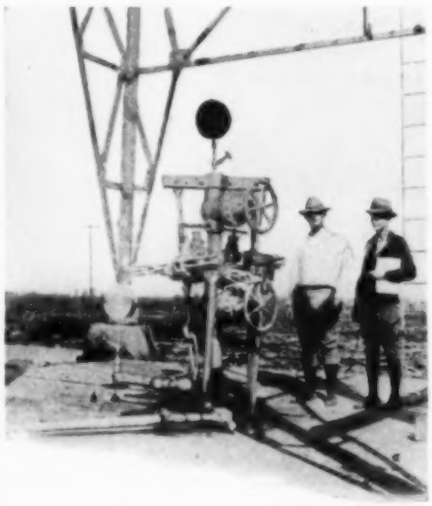
As additional security in low-cost fuel, the writer includes here the extensive deposits of brown coal which are laid down in blanket form at shallow depths in an unbroken line of outcrop from the Rio Grande to the Louisiana line.

Since it is evident that State and Federal regulatory measures, restricting the production of crude oil to "consumer demand," are intended to be permanent, and since such measures have already increased the scarcity of fuel oil and elevated the price, fuel oil can no longer be included as a low-cost fuel. Refineries which skim light products from crude oil, thereby supplying fuel oil, are no longer profitable under the new restrictions and more and more crude oil has been diverted from skimming plants into cracking stills.

But, with abundant reserves of natural gas, backed by reserves of brown coal estimated at some 30 billions of tons in place—easily mined and sometimes in open cut—there is ample assurance of a continuous supply to process industries requiring low-cost fuel.

Brown coal contains about 8,500 B.t.u. per pound as mined, and, when pulverized and blown into furnaces, affords excellent furnace efficiency. Two central power stations in Texas, in fact, are so equipped. Brown coal, however, is friable, will not coke and requires twice the furnace volume used with fuel oil.

Although many brown coal mines once operated successfully, the advent of fuel oil at a low price closed down most of the mines, and now natural gas at a still lower delivered cost prevents the mining of brown coal on a large scale.



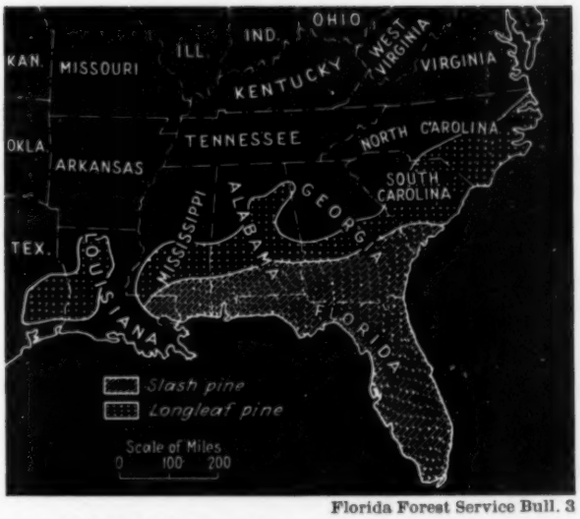
High-pressure well-head hookup

Above: Natural gas intake lines at compressor plant

Right: Pledger Plant of Paramount Natural Gasoline Corp., Brazoria County, Texas; extracts butanes, propane and natural gasoline, discharging dry gas to pipe line

Southern Resources Attracting Newsprint Industry

By JAMES A. LEE
Managing Editor of Chem. & Met.



Florida Forest Service Bull. 3

199,000,000 acres of pine trees are waiting the coming of newsprint mills

SEVERAL recent developments have called the attention of the world to the possibilities of the Southern states of this country as a location for a white paper industry of important proportions. In 1920 kraft paper was first produced in the South and since then 75 per cent of the new production of this type of paper has been located in the Gulf States. During the past few years the feasibility of the Southern pines for white paper has been demonstrated by Dr. Charles H. Herty and the staff of the Pulp and Paper Laboratory of the Industrial Committee of Savannah. More recently have come the development of the vast suppiy of hydroelectric power in the Tennessee Valley, the building of a vast alkali industry in Louisiana and Texas, and the development of the sulphur deposits at Lake Grand Ecaille and Jefferson Lake, La.; finally, but not of least importance, is the attitude of the present administration at Washington which is favorable to industrial development of this nature in the South. Plans for the construction of a newsprint mill are being formulated by the Southern newspaper publishers. It appears likely that what has occurred in the kraft industry will also come to pass in the field of white paper.

For several years a few Southern mills have produced a white paper from the pine wood by other than the regular sulphite process, and one or two additional plants are soon to offer bleached sulphite paper. But during the past few years Dr. Herty and his associates have experimented with the woods of the various kinds of pine trees that are found so abundantly in the South in an effort to determine whether newsprint and other white papers could be produced from these trees by the method standard in other parts of America. It has been found that the resin in the pines was not the dreaded obstacle expected. The other possible objections that have been raised from time to time have all been proved to be without foundation. Finally, a commercial test was made. Both groundwood and sulphite pulps were produced from loblolly pine in the experimental laboratory at Savannah and shipped to the mill of the Beaver Wood Fibre Co. at Thorold, Ont. These pulps were converted into newsprint in an 8-hr. run without even one break. The paper was then returned to the state from which it originated and there distributed to nine newspaper publishing companies which used it in printing special editions on Nov. 20, 1933.

The newsprint was made from 25 per cent sulphite pulp and 75 per cent groundwood. In preparation for the run no changes were made in either the presses or calender stack; and the wet end chests, wire pit and other equipment were thoroughly cleaned. The stock was furnished to the beaters where it was repulped, proportioned, and so forth, and sent to the machine chest. It was run through the paper machine at 715 ft. per min.

It has been reported that the sheet on the wire appeared good, and no particular difficulty with either head screens, wire or couching was apparent. In fact no unusual difficulties were noticeable in handling the sheet through presses, dryers or calenders. And of particular interest was the fact that no trouble was encountered with pitch.

True, this pulp lacked the fineness of fiber that is produced from Canadian spruce, in that the difference in smoothness and uniformity compared to Canadian pulps was apparent in hand sheets, and that the fineness of pulping is also reflected in the higher Mullen test on spruce. True this newsprint did not measure up to the best newsprint produced in Canadian mills, but these details, it is assumed, can be corrected with some little further experimentation. It is sufficient to state that both groundwood and sulphite pulps have been made from the Southern pine and that these have been successfully made into newsprint under normal conditions with no unusual difficulty, and lastly that the paper has been used for the printing of several newspapers.

But the bare fact that newsprint can be made from the

Southern pine is not sufficient to justify an industry below the Mason and Dixon Line. The location of a newsprint mill depends upon several factors: the most important of which are abundance of raw material, cost of transportation to mill, market for finished product, cost of transportation to the market, power, water-supply and labor.

Raw material—White paper can be produced from the slash, long leaf, short leaf, Virginia, and loblolly pines. These varieties of pine trees grow extensively in North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. Of these trees there are now 199,000,000 acres waiting for the coming of the mills. This territory includes 100,000,000 acres of cut-over land not needed for agriculture, 57,000,000 acres of farmers' wood-lots, 25,000,000 acres of abandoned farm lands, and 19,000,000 acres idle because of the cotton curtailment program that can be seeded in pines. And what is even more important is the fact that due to the long growing season and heavy rainfall these trees are ready for harvesting in nine years from the time the seeds are planted, which assures a perpetual supply of wood within a few miles of the mill.

In fact, a newsprint mill with a capacity of 400 tons per day, which is considered a large mill, using 1⅓ cords of wood per ton, would require only about 120 sq.mi. of timber land to maintain a supply as compared to about 1,200 sq.mi. in Canada. This is on the assumption that Southern pine can be counted on to produce 1½ cords per acre per year which is believed to be a conservative estimate.

Weather—The mild weather in the South has its advantages. It is not necessary to accumulate in storage at the mill the 50,000 to 100,000 cords of pulp wood that many mills in the colder climates are required to have in the winter months. Decay losses incident to storage and carrying charges on stored wood are eliminated. Logging and delivery can be continuous throughout the year, and a week or ten days' supply of wood ahead of requirements is all that is necessary. Consequently the working capital for entire pulpwood operations is much less than in the North. The price of $4.60 for the 1¼ ton of wood in the south compares with $10 for the wood requirements per ton of newsprint in Canada.

But the pines offer other advantages. It has been demonstrated that these trees can be planted on the farm and in no way interfere with the raising of other crops between the rows of pines, the growth of the pines being greatly accelerated as a result of the cultivation of the farm crop. And of even greater importance is the triple use to which the pine forest may be put. While only the young trees will be used for paper making, the older trees can be sold for lumber. And further, while waiting for the trees to become large enough to use, the naval stores may be collected and sold.

Other raw materials—The South has salt, limestone, clay, and rosin in abundance. It has large deposits of sulphur in both Louisiana and Texas. A very large supply of soda-ash and caustic soda are assured by the large alkali plants now under construction at Baton Rouge and Lake Charles, La., and Corpus Christi, Texas. And it is safe to assume that any one of these plants or others will be ready to supply chlorine when the bleachers of the new white paper mills are ready to operate. Since both Southern and Canadian mills would depend upon the Gulf Coast sulphur deposits, the cost of this commodity to Southern plants should be less owing to much shorter transportation distances.

Since 1920 75 per cent of new production of kraft kraft mill of the

Markets—While the Southern states consume only 6 per cent or 225,000 tons of newsprint annually, mills in these states will be in a favorable position to compete with Canadian mills for the Boston, New York, Philadelphia, Baltimore, Washington and Chicago markets. Water rates on newsprint from Atlantic Coast points in the South to the Eastern cities indicate a difference in transportation costs in favor of the Southern mills of about $4 a ton over rail rates from mills in Ontario, Quebec, and New Brunswick to similar delivery points.

Power—Mills located in the Tennessee Valley or other interior points will be able to obtain favorable hydroelectric power rates. But in all likelihood the first plants will be established on the coast in which case they will have to depend upon a steam turbine generating plant for motive power and steam. This should not prove to be a handicap for power generated in modern high-efficiency steam plants is today successfully competing with hydroelectric energy, and with the prevailing price of oil and coal in the South, power can be generated from fuel at favorable cost. The cost of power plus steam for a Southern mill would just about equal the cost of these products in an average Canadian mill.

Water—The plentiful supply of water that is required for paper making is to be found in the South. The rivers, bayous, creeks and other streams of the coastal plain afford a supply of naturally soft water.

Labor—Southern industry has an advantage over industry in other sections in labor. For there is an abundance of intelligent native white labor. Machinists, millwrights, and other skilled workers are readily obtainable in this section. And for operations requiring only

paper has been located in Gulf States, Mobile, Ala., International Paper Co.

strength, there could be no better laborers than the negroes. However, the general trend of labor rates in the South is towards the standard rate paid in other sections of North America; consequently, it is advisable to consider that the total labor cost per ton of white paper in the South would be only slightly less than for similar work in the North.

Capital—A. A. MacDiarmid, chief engineer of Price Brothers & Co., Canada, is authority for the statement that "a reasonable capital requirement for a balanced 4-machine mill, with sufficient timber limits, in Eastern Canada, exclusive of any hydroelectric plants but including working capital, should be about $32,000 per daily ton, whereas in the South a mill on the same basis but including power plant can be set up for about $29,000 a ton. Interest, sinking fund, and depreciation on this difference of $3,000 at 12 per cent means about $1 a ton in favor of the South."

The cost of paper per ton from Southern pines has been calculated by Dr. Herty. His figures which appear in the accompanying table are based on a 150-ton daily capacity or 45,000 tons annual production.

In commenting on each of these items, in a recent issue of *Paper Trade Journal*, L. C. Anderson of the Ontario Paper Co. concluded his remarks with the statement that the total conversion cost of $19.06 per ton would quite likely be met in operation. In 1933 another Canadian pulp and paper engineer stated that the conversion costs in that country amounted to $27.90 per ton, which is a striking contrast to the foregoing estimate of $19.06 in the South.

The interest of the Administration at Washington in this development has not as yet been felt, but it is known to be friendly by several remarks that have been made by high officials. President Roosevelt, after a conversation with Dr. Herty last year stated: "Dr. Herty and I first discussed the use of Georgia pines at least four or five years ago. I have been following his experiments ever since. I am delighted that his dream has come true and that we are to use Southern pines for newsprint purposes." On May 23, Major George L. Berry, divisional N.R.A. administrator extended an invitation of the N.R.A. to the Southern Newspaper Publishers Association to cooperate in establishing the newsprint industry in the South. He told the publishers that with the approval of Gen. Hugh S. Johnson, the N.R.A. administrator, a plan was already in preparation contemplating factual findings regarding the newsprint industry. "Upon this subject of newsprint and the resources of the Southland augmented by cheap power," he asserted, "there comes to you an opportunity for the development of newsprint equal to the requirements of the newspaper publishers in the South that will not only go far in the stabilization of the business, but will bring to your Government an income from its power that will transcend that from any other enterprise now in the South, or any that is now contemplated."

As further evidence of the government's interest is the recent announcement that the National Forest Reservation Commission headed by Secretary of War Dern is building a 6,000,000 acre Southern pine preserve. "Plans for a Southern newsprint industry form one of the elements considered," according to John E. Burch, secretary of the commission. The acreage as reported by the *Paper Trade Journal* includes 22 units in Mississippi, Texas, Louisiana, Florida, North and South Carolina. In six units 1,930,017 acres have been

Cost of Paper From Southern Pines

Alum	$0.10	
Color	0.06	
Wrapper	0.30	
Sulphur	0.60	
Limestone	0.10	
Clay	0.04	
Wood (1.15 cords—rough—$4)	4.60	
	$5.80	
Labor, including administration	5.06	
Pulpstone	0.20	
Felts	0.60	
Wires	0.25	
Belting	0.10	
Lubricants	0.08	
Steam	1.50	
Electric power	4.00	
Finishing	0.50	
Liability insurance	0.15	
Teaming	0.15	
Miscellaneous materials	0.15	
Repair materials	0.50	
	$13.26	
Total conversion cost		$19.06
Capital charges (based on a total investment of $4,027,500):		
Interest at 6 per cent	5.37	
Sinking fund at 2 per cent	1.79	
Depreciation at 5 per cent	4.48	
Taxes and insurance	0.25	
Selling expense	0.75	
	$12.64	
Total conversion cost	19.06	
Total cost per ton		$31.70

acquired through purchase or through exchange of reserve lands or are in the course of purchase. There are 4,324,831 acres yet to be obtained. The proposed gross acres include: South Carolina, three tracts of 1,265,000 acres; Florida, four tracts of 1,087,000 acres; Mississippi, six tracts of 2,175,000 acres; Louisiana, four tracts of 933,000 acres; Texas, four tracts of 1,400,000 acres and North Carolina, three tracts of 977,000 acres. While these figures exceed the 6,000,000 acres finally anticipated, some of the designated land will be left unacquired because of high price demands.

Assurance of at least one newsprint mill for the Southern states came with the announcement on July 29 of the Southern Newspaper Publishers Association that arrangements had been made for the construction of a newsprint mill in the South. James G. Stahlman, chairman of the newsprint committee and publisher of the Nashville Banner said that a sub-committee had been appointed to "proceed at once with plans for the early erection and operation of a newsprint mill in the South, utilizing Southern pine."

This committee of the Southern publishers has been investigating the possibilities of going into the production of newsprint for several months. At the July 29 meeting in Nashville at which the final decision was made Cramstan Williams, secretary-manager of the S.N.P.A. reported on the result of a questionnaire sent out two weeks before to the 219 members of the association asking information regarding their use of newsprint. He said that the questionnaire included queries regarding past newspaper tonnage requirements, present newsprint contracts, sources of newsprint origin, and contractual commitment for the future. Responses by members of the association he declared to have been "highly satisfactory."

Other members of the association who attended this important meeting included E. K. Gaylord, publisher of the Oklahoma City Oklahoman and Times and president of the S.N.P.A.; Emanuel Levi, vice-president and general manager of the Louisville Courier-Journal and Times; James L. Mapes, publisher, Enterprise and Journal, Beaumont, Texas, chairman of the board of the S.N.P.A.; Clark Howell, Jr., vice-president and general manager of the Atlanta Constitution; Curtis B. Johnson, publisher, Charlotte Observer; Myron G. Chambers, business manager, Knoxville News-Sentinel; Victor H. Hanson, publisher, Birmingham News and Age-Herald; Henry P. Johnston, publisher, Huntsville Times; and John Coffin, representing the Hearst newspapers.

Is it any wonder then that the Dixie enthusiasts are confidently looking forward to the coming of an industry second in importance only to cotton?

South Offers Opportunity for Soap and Glycerine Industry

By OSCAR H. WURSTER

Wurster & Sanger, Inc., Chicago, Ill.

THERE HAS BEEN considerable interest recently in the establishment of a soap industry in the South. The consideration of such a project requires a thorough study of the present economic and technical factors involved and also gives rise to the question as to why no large soap plants have developed south of the Mason and Dixon Line.

The manufacture of soap is one of the consumer goods type of industries and, generally, the location of plants has followed the trend of population. This, however, has not invariably been the case and the fact that there is now no large soap plant in the South or Southwest is perhaps the most notable example in this industry.

In the past, soap plants have sprung up in almost all communities. The population determined the retail consumer demand and also largely controlled the development of other industries which supplied the soap maker his raw materials as well as outlets for some of his products such as bulk soap, industrial soaps for special uses and glycerine. Thus, animal fats—tallows and greases—were available, roughly, in proportion to requirements. Vegetable oils, such as cottonseed oil and corn oil, were brought in, when used, from points of production in this country and other vegetable oils required, such as coconut oil and palm kernel oil, were imported. The alkalis were obtained where purchase was most advantageous. The minor ingredients and supplies had no important bearing on location.

The local market for the soap and other products largely determined the growth of the plant. As this market increased and the plant expanded, production costs decreased and this put the manufacturer in position to compete favorably, even with higher transportation charges, against smaller competitors in more distant localities. So the large plants grew larger and the small plants disappeared.

In the matter of location of the earlier plants which grew to large size, the controlling factors appear to have been availability of the raw materials and market for products. That, however, does not account for the development of the soap industry in certain cities to the

exclusion of others which might have been equally well suited. That appears to have been more or less accidental, the result of the fact that someone with the necessary ability started in a given place.

In this connection it is interesting to note that in some cities several large plants have developed while in other large cities, equally well situated, there are no large soap plants. Again, in several large cities which had substantial soap plants, the industry has entirely or almost entirely disappeared. It is rather obvious that business conditions as applied to each plant were the controlling factors rather than geographical location, raw materials or market. The inception and development of these plants were the result of individual initiative and ability rather than of any far-sighted economic planning. In fact, some favorable conditions existing in certain localities when the soap plants started there gradually diminished, but the industry went on successfully.

Transportation costs of the finished product have always been a factor and the local and nearby markets were covered most successfully. Even so, national or distant distribution was possible. As transportation costs increased it became essential for the large producers to decentralize their manufacturing operations and in recent years large plants have been located in various parts of the country to take care of the required regional demands without excessive distribution charges. These plants have been located with a consideration of sources of supply of raw materials, transportation, labor, market and other factors.

In view of the present and recent developments in the chemical industries in the South, it is of interest to note that the close connection of the soap industry with the chemical raw materials industries, more especially acids and alkalis, has existed since the earliest days. A pioneer producer of sulphuric acid, whose business has since become a substantial part of one of the largest units of the nation's chemical industries, was sponsored and financed by one of the pioneers in the soap industry who required sulphuric acid for the fat splitting process in his own plant.

No Large Soap Plant in South

In considering a soap plant in the South or Southwest we have, then, the facts that no large plants have developed there naturally, nor have the large producers, in locating their new plants in the process of decentralizing their manufacturing operations, located in this extensive and important territory. It would seem that there should be a more substantial reason for this than that it merely did not happen to be done. But, after considering the situation, that appears to be a large part of the explanation. Conditions and economic factors are favorable.

Many of the present plants are so located that transportation costs into this territory are fairly low and they have been in position to compete for the business from their existing locations. That is probably the principal reason why the large manufacturers have not established branch factories in the South. It does not explain, however, why local competition has not developed from within the territory. This will probably have to be explained merely by the opinion that no one with the necessary initiative, ability and resources has heretofore conceived and successfully carried out such a project.

In the manufacture of soap, availability of the raw materials, proximity to markets, good distributional facilities and favorable labor and living conditions are the most important factors. A Gulf Coast location would seem to meet these requirements.

The essential raw materials are fats and oils, alkalis, sodium silicate and rosin. Domestic fats and oils are available in the South. New Orleans has long been an import center for vast quantities of coconut, palm and palm kernel oil and a large market for the entire South in handling cottonseed oil and its products. Cottonseed oil foots are at hand. A considerable portion of the oils used by soap manufacturers in the United States passes through New Orleans at the present time. It can be intercepted here with considerable saving in subsequent transportation expense. Alkalis have not been available in the South heretofore but three projects are now under way in the Gulf Coast territory. Rosin is available throughout the South and glass sand and alkali are there for making sodium silicate.

Factors Favor Southern Plant

Labor and living conditions have been found satisfactory by other plants which have located in the South. Labor experienced in cottonseed oil refineries and other process industries would be promptly available. Production costs would probably be lower than in other sections of the country and operating conditions are reported favorable by other enterprises.

The distributional facilities of various locations in the South and more particularly of New Orleans are exceptional. Nowhere else in the United States are found such a complete coordination of the four major transportation mediums—railroads, inland waterways, coastwise and over-seas steamship service. These shipping facilities open the entire territory to rail shipment; provide for barge service over the inland waterways system and packet service to nearby points; give coastwise service to the large Eastern markets and to the Pacific Coast, as well as to Gulf points; and provide for export to Central and South America.

The markets are, of course, determined by population and the ability to reach the bulk of that population by economical transportation methods. The various combinations of transportation services as cited above for New Orleans or in the adjacent industrial areas afford a flexibility with respect to freight rates to extremely populous sections of the United States not enjoyed by inland communities.

To stress the importance of the Southern market for soap it is only necessary to point out that the population of the eleven Southern states exceeds 28,000,000 people. This population is divided fairly evenly between the seven states east and the four states west of the Mississippi River. Other regional industries now serving this population afford a natural outlet for the refined glycerine as well as for industrial soaps, which are important products of every large soap plant.

It appears that the existing market and facilities of this area, together with the other factors enumerated, offer such exceptional advantages for the establishment of this industry in the South as to presage early location of a soap plant in this territory.

Economic and Technical Factors

By JOHN H. PERRY
E. I. du Pont de Nemours & Co.
(Grasselli Chemical Co.)
Cleveland, Ohio

and

CHARLES W. CUNO
Consulting Chemical Engineer
Mississippi Valley Research Laboratories
St. Louis, Mo.

Maps Courtesy of Industrial Bureau, Industrial Club of St. Louis

Favorable location of these cities accounts for their producing 70 per cent of U. S. manufactures

A STUDY of the fundamental economic and technical factors of plant location should rightly be prefaced, if space permitted, by a review of the available material in the literature. (See plant location bibliography prepared by the authors, pp. 439-42, this issue, EDITOR). Much of value has been written on the more general aspects of the subject. A great deal of the published literature consists of industrial surveys, many of which are quite patently propaganda for certain cities or sections of the United States. If well prepared, they usually limit themselves to a description of the resources, labor supply and marketing conditions within a limited area.

Production concerns itself chiefly with operations increasing the value of raw materials through changes in form, thus adding *form value*. Distribution, on the other hand, involves transportation, storage and retailing, and so adds *place, time,* and *subdivision* value to goods on their way to the ultimate consumer. These functions, necessary or desirable as they may be, are not fundamental, for they do not add "social value" to the product. Hence it is that the possibility of the partial elimination or curtailment of the functions of distribution is as important in determining plant location as are production economies that may ensue. In fact, it seems likely that the greatest future economic trend will be in the direction of reducing the dependence of goods on the railroads, storage institutions, wholesalers, jobbers and retailers.

Those studying industrial developments have made statements that seem to apply to various industries. It has been said that in the iron industry the ore goes to the fuel; that in the manufacture of carbide, abrasive and aluminum products, the industry goes to cheap hydroelectric power; that the measure of sulphuric acid manufacture is local consumption; that the soda ash and caustic industries must locate near the salt deposits. But these views are often superficial. We note, for instance, the great development of pig iron and steel manufacture in Illinois, Indiana, and Ohio, where there has been a compromise between the ore haulage from Michigan and Minnesota and the fuel haulage from Pennsylvania and West Virginia in order better to serve the shift of demand caused by the westward migration of population; caustic soda manufacture where there is a highly competitive market for salt; and sulphuric acid where sulphur dioxide is a byproduct of copper and zinc smelting.

The rapid development of the United States, even before the Civil War and certainly in the last three decades of the nineteenth century, showed a very haphazard location of industry where many developments failed, and also a definite centralization for which there seems little economic reason. Why cotton goods manufacture and shoes should centralize in New England; collar manufacture in Albany, N. Y.; rubber at Akron, Ohio; and automobiles in Detroit, is still unexplainable. Perhaps one of the first of these centralized industries to break away from its moorings and locate elsewhere was the shoe industry, followed soon after by the westward migration of iron and steel manufacture, the southern trend of sulphuric acid manufacture, cotton goods and rayon. Profound changes are especially notable in the essentially technical industries, fertilizer manufacture, glass, coke, alkali, paper and wood pulp, coal tar products, paint and varnish, sulphuric acid, and soap, which are usually classed as basic.

Types of Industry

Examination of industry leads us to certain classifications as to general type. We have, for example, certain industries, of which the chemical industry is one, in which little of the finished product ever reaches the ultimate consumer. Most heavy chemicals are reabsorbed into other industry. This also may be said of the manufacture of pig iron, steel, and metallurgical coke, and largely of cement, gravel, lime, pigments, cotton, and a host of other products. Such industries may well be classed as basic or feeder industries, whose products are for the most part raw materials for succeeding industrial endeavor.

Then there are certain industries which begin with these semi-finished products and process them further, either to be fabricated by other industries or for the ultimate consumer. These industries may be termed intermediate or consumer industries. There are also those

in Chemical Plant Location

ECONOMIC FACTORS OF PLANT LOCATION

FACTORS OF PRODUCTION

1. **Raw Materials or Semi-Finished Products: Quality, reserve, proximity to plant; competitive sources.**
2. **Labor: Supply and cost in kind, nationality, quantity, diversity, intelligence, wage scales, efficiency.**
3. **Water: Sources, mineral analysis, bacterial content, turbidity, quantity, seasonal temperatures, costs.**
4. **Power: Hydroelectric, public service, alternate sources.**
5. **Fuel: Kinds, thermal efficiency, reserve, alternate sources.**

FACTORS OF DISTRIBUTION

1. **Transportation Facilities: Railroads, steamship lines, barge lines, terminals, wharves.**
2. **Freight Rates: Competitive points, differentials, favorable territory.**
3. **Markets: Local area, favorable area, competitive area, national area.**
4. **Competitive, Feeder, and Consumer Industries.**

PRODUCTION AND DISTRIBUTION FACTORS

1. **Climate: Seasonal range, precipitation, humidity, wind, etc.**
2. **Taxes and Corporation Fees.**
3. **Municipal Restrictions: Nuisance laws relating to fumes, waste disposal, etc.**

industries that take on more or less national characteristics and attempt to serve a large territory. Again, there are those that are local or tributary to a certain section or city such as the laundry, the bakery, the brick plant, etc.

We have also industries which are complimentary to each other. Coke is manufactured chiefly for the metallurgical industries, and a large part of the sulphuric acid manufactured in the South is absorbed by the fertilizer industry.

In locating the chemical plant, economic factors can immediately be grouped into those concerned with efficient production, those concerned with efficient distribution, and those affecting both production and distribution. The 12 most important economic factors have been so grouped elsewhere on this page.

Factors of Production

Raw Materials—Raw material sources may be local, either favorable, or competitive, and are valuable to a community because of quality, reserve, proximity, and source of competitive material. Raw materials have really no geographical limitation, but are tributary to a certain district, where economic conditions such as initial cost and freight rates are more favorable than in other points of similar manufacture.

To nomadic races, land had little value. To agricultural races, its chief value was fertility. To our complex civilization, its value as a source of raw material is fast overshadowing that given to it by agriculture. This is strikingly evident in many ways. Thus a piece of land for agricultural purposes, due to its fertility and consequent yield under cultivation, may be worth, say, $200 per acre. If a 40-ft. ledge of limestone on this land is developed to the point where it yields a royalty to the owner as low as 5 cents per ton, the value of this land would become approximately $7,000 per acre. The discovery of high grade iron ore in the same size ledge would give each acre a potential value of more than $250,000.

It is here contended, therefore, that land as a potential source of raw material is constantly becoming increasingly valuable as new discovery, research, and new industrial applications bring into usefulness those valuable elements which the land has held as a potential source of wealth for countless ages.

Labor—The supply and cost of labor involves such items as: Kind, nationality, quantity, diversity, intelligence, existing wage scales, and efficiency. In general, wages are lower in the Southern states than in the North Atlantic and the Mississippi Valley states. On the other hand, in quantity, diversity, intelligence, and efficiency, the labor in the cities will be found more satisfactory than in the country. Labor of certain nationalities is more dependable, intelligent and efficient than others.

City Conditions Favor Industry

Outside of agriculture, the logical location of industry is the city. There we have large reservoirs of labor, the facilities for distribution, for barter and trade and the concentrated reservoirs of consumption. In making the above statement, we are mindful of the fact that certain industries have gone to the country with apparent success, but their success has frequently depended upon the present ability to exploit cheap country labor, a condition that we believe is bound to pass.

Water Supply—To more than 75 per cent of the basic industries water is one of the governing factors in plant location, and quantity, analysis, and costs are the chief points considered. For all water uses, the greatest requirements of the sources of supply are their dependability and the possibilities for added sources.

For process purposes in chemical plants, water is frequently a raw material. Hence, quality (mineral content, color and turbidity, and frequently bacterial con-

tent) must be satisfactory; and temperature is often a criterion.

A paper by Collins (Temperature of Water Available for Industrial Use in the United States, U. S. Geological Survey, Water Supply Paper, 520-F.) is a source of data and information on many available water sources that will usually be found to be satisfactory. For sources not covered by Collins, the chamber of commerce of the locality nearest to the proposed plant location will usually be found anxious to obtain and forward such information. In all events, it should be remembered that any future expansion of the proposed plant will require additional quantities of water and the sources of supply in the original survey should be proved to be ample for such possible expansions.

Power—Power usually may be classed as hydroelectric or steam-generated power. In some cases process steam can be purchased because of proximity to industries having excess for sale, but such propositions must be investigated very carefully. The city with cheap hydroelectric power has a serious argument for industrial development, but steam power plants are fast equaling hydroelectric performance.

Table I—Average Price of Industrial Power (Large Light and Power) for 1932

(From U. S. Bureau of the Census, Release L.P.-6, Second Series)

	Average Price Per Kw.-Hr., Cents		Average Price Per Kw.-Hr., Cents
New England		**West North Central (Cont.)**	
Maine	0.8	South Dakota	3.4
New Hampshire	1.7	Nebraska	1.5
Vermont and Rhode Island*	1.9	Kansas	1.4
Massachusetts	2.0	**South Atlantic**	
Connecticut	2.0	Delaware, Dist. of Columbia, Maryland, West Virginia*	1.4
Middle Atlantic		Virginia	1.4
New York	1.6	North Carolina	1.1
New Jersey	2.1	South Carolina	1.1
Pennsylvania	1.5	Georgia	1.2
East North Central		Florida	1.5
Ohio	1.6	**West South Central**	
Indiana	1.8	Arkansas	1.7
Illinois	1.7	Louisiana	1.2
Michigan	1.4	Oklahoma	1.9
Wisconsin	1.5	Texas	1.6
West North Central		**Pacific**	
Minnesota	1.7	Washington	0.7
Iowa	1.5	Oregon	0.9
Missouri	1.3	California	1.4
North Dakota	4.1		

*Combined to avoid disclosing operations of individual establishments.
Note: Statistics for East South Central States of Kentucky, Alabama, Mississippi and Tennessee; and Mountain States of Montana, Utah, Idaho, Wyoming, Colorado, Arizona, New Mexico and Nevada cannot be shown without disclosing data for individual establishments.

Power Dependability Paramount

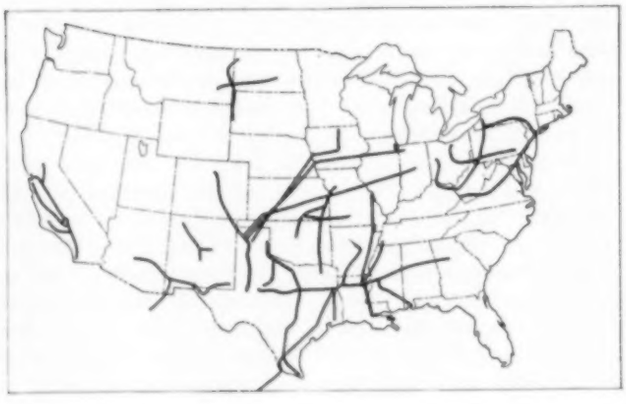
If, as is usual in many plants, the electric power is purchased from an outside company, the items of importance to be considered are, in the order of their importance, dependability and cost. Under these conditions of purchased power, the buyer will obtain greater dependability if he is in a location served by two or more independent power sources. If there is only one power source available in the location, the buyer should, if possible, be served from more than one central or substation, or, if only one central or substation is available, definite assurances of suitable service, replacement of transformers damaged by electric storms, etc., should be obtained.

If the proposed plant intends to generate its own electric power, a location that permits obtaining the required coal from two or more sources will increase the dependability of the fuel source and will also assist the purchasing department in its work of obtaining the most favorable fuel contracts.

In regard to the cost of purchased electric power, the rates as they are affected by peak loads, actual bracket of consumption, and power factors, should be investigated carefully.

Fuels—The chief commercial fuels in the United States are coal, coke, oil and gas. Of the 48 states, 38 produce coal, and petroleum is now produced in 19 states and refined in 29. More than 20 states produce natural gas and 11 more obtain it by pipe line from beyond their borders. Metallurgical coke is produced in 20 states and a number of others produce domestic and petroleum coke. In heat equivalent, natural gas at $0.20 per M cu.ft. is roughly equal to fuel oil at $1.20 per barrel, coal at $4.80 a ton and coke at $5.60 a ton.

Important natural gas trunk pipe lines in the United States



Factors of Distribution

Transportation Facilities—When a situation has more than one railroad, or better still, railroads and barge or steamship connections, the freight competition occasioned by these several transportation facilities makes for lower freight rates, efficiency, and service. This factor of plant location is frequently of greater importance than those of raw materials and markets. It may often be of greater importance than any other factor. Adequate and favorable transportation facilities will increase the permissible shipping distances for raw materials as well as products and will thus increase operating returns.

Inland Waterways—The most favorable transportation is frequently that of waterways, mainly on account of its cheapness as compared to that of transportation by land. The earlier manufacturers looked to the sea for their main outlet. Later inland waterways—navigable rivers and canals—became controlling factors in the development of industries. By 1840 the major part of the settled portion of North America was accessible by water and it was not until after the panic of 1873 that railroad development assumed such proportions that waterway transportation took second place. From that point it began to dwindle. No new waterway developments of major importance were undertaken by the Government for a period of three or four decades. In fact the Panama Canal and the Mississippi River Devel-

opment (the latter still incomplete) are perhaps the only major government projects since that time. Holmes ("Plant Location," McGraw-Hill Book Co.) has listed the inland waterways of the United States as they appear in Table II.

The Great Lakes—Transportation over the Great Lakes has persisted in spite of railroad competition. This influence on plant location has been tremendous as witnessed by the phenomenal growth of such lake ports as Chicago, Milwaukee, Toledo, Detroit, Cleveland, Buffalo, etc.

Coastal Commerce—Not only on the Atlantic coast but on the Gulf of Mexico and the Pacific this form of transportation plays an important part in our economic life. The numerous navigable coastal rivers make steamer and barge service available at many locations and as such freight rates are invariably lower than railroad tariffs, this mode of transportation has a profound effect on industry and also on the tariffs of railroads.

Table II—Inland Waterways of the United States

(After Holmes, "Plant Location," McGraw-Hill Book Co.)

Name	Miles Navigable	Name	Miles Navigable
Atlantic Coast		**Gulf of Mexico (Cont.)**	
Cape Fear	145	Atchafalaya	150
Connecticut	50	Black Warrior-Tombigbee	398
Delaware	80	Brazos	250
Hudson	150	Coosa	195
James	100	Mississippi-Missouri	664
Kennebec	40	Ohio	968
Pamlico and Tar	100	Mobile	45
Pedee	170	Neches	135
Penobscot	25	Sabine	60
Potomac	100	Suwanee	130
Rappahannock	100	**Pacific Coast**	
Santee	140	Columbia	330
Savannah	250	Sacramento	260
St. Johns	275	San Joaquin	200
Waccamaw	40	Snake	145
Gulf of Mexico		Willamette	160
Alabama	300		
Apalachicola and Flint	400		

Principal Canals

Name	Location	Length, Miles	Depth Feet
Cape Cod Ship	Buzzard-Cape Cod Bay	7	25
Cayuga and Seneca	Geneva-Montezuma, N. Y.	25	7
Champlain	Whitehall-Troy, N. Y.	80	5
Chesapeake & Delaware	Delaware River-Chesapeake Bay	13	10
Chesapeake & Ohio	Washington, D.C.-Cumberland, Md.	180	6
Chicago Drainage	Chicago-Lockport, Ill.	32	22
Erie Barge	Troy-Tonawanda, N. Y.	122	12
Delaware & Raritan	New Brunswick-Bordentown, N. J.	44	8
Delaware Division	Easton-Bristol, Pa.	60	6
Dismal Swamp	Virginia-North Carolina	22	9
Fairfield	Fairfield-Alligator River	4	7
Harvey's	Miss. River at New Orleans	13	6
Illinois & Mississippi	La Salle, Ill.-Miss. River	75	7
Lake Borgne	Mississippi River-Lake Borgne	7	6
Lake Washington Ship	Puget Sound-Lake Washington	8	30
New Basin	New Orleans-Lake Pontchartrain	6	10
Old Basin	New Orleans-St. Johns Bayou	2	5
Oswego	Oswego-Three Rivers	23	12
Schuylkill Navigation	Philadelphia-Port Clinton	50	6

Railroads—Railroads are still the chief means of transportation and, curiously enough, the chief reason for their present difficulties is not competition from river and lake and coastal traffic, but the competition caused by truck traffic upon our roads. So tremendous has been this defection that in many commodities, as, for instance, shipment of live stock, more than 80 per cent now travels by truck instead of by rail.

Other Transportation—Truck competition has reached the point where Government regulation will have to step in. Such cities as Chicago, St. Louis, Detroit, Cleveland, Cincinnati, etc., have each as many as from 200 to 500 individual trucking companies carrying l.c.l. and package freight from 10 to 500 miles at rates that are not only much less than railroad tariffs but so low that they can not take care of repairs and replacements on equipment, let alone make a legitimate profit on the capital invested.

Among transportation means should be mentioned express, parcel post, and air mail, all of which are specialized services giving speed and facility and usually at a higher price than freight service.

For less-than-carload shippers there is also a service by the railroads which operates mainly between large cities. This service is little known to the layman and is called package-car or merchandise-car service. Such cars are made up by the railroad at its freight depots and are loaded with l.c.l. shipments all destined to one terminal. Thus the car is not opened until it reaches its destination. Package-car service may be daily or at less frequent intervals, depending on the average movement of freight. It is designed to give express service at l.c.l. rates.

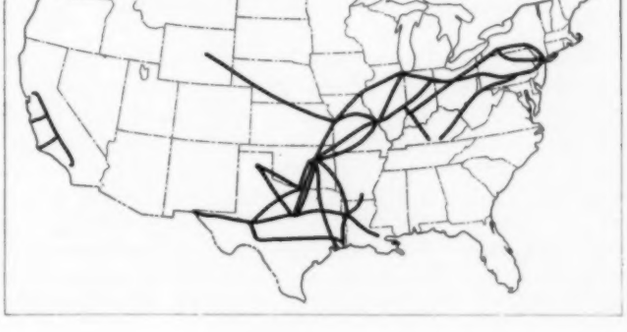
Freight Rates—The larger the territory favorable to certain districts on account of favorable freight rates, and the larger the population reached in this territory, the more important that district becomes as a potential industrial center. An industry seeking location in a certain territory must examine the freight rate situation very carefully.

Railroad freight rates still govern or influence rates on all other forms of transportation. It is quite true that this influence has been mutual, that is, that lake, river and coastal transportation has caused railroads to quote competitive rates in order to meet this cheaper transportation, but as these lower rates do not apply to intermediate points, they have only complicated the freight rate situation. Freight rates to intermediate points are often higher than through rates.

"What the Traffic Will Bear"

With railroads there is a sizable fixed charge on all transportation before any service is rendered. Furthermore, the services rendered at the sending and receiving ends of the transaction, termed "switching," are proportionately much more expensive than the actual travel from city to city. It has often been said, therefore, that the actual freight rate is made up of the two switching charges at each end plus a mileage rate between the two

Important oil trunk pipe lines in the United States



points, but this is only the theoretical basis of freight rate making. Many other factors enter into the problem, for example, the bulk-value relations of the commodities carried. Rates are, therefore, made not on cost per ton mile to the railroad but on what has been termed "What the traffic will bear." Goods are classified according to their value into first, second, third and fourth class and there is often a fifth or commodity rate which is a special rate usually lower than any of the four, and applying only to or from certain cities or common territories.

Raw Material Rates Influence Location

The plant location engineer must recognize, therefore, that freight rates play an important part in the wise location of industry. Wide differences between the freight tariff paid on raw materials shipped to the proposed location and that paid by rival companies can hardly be made up by savings in production or operation. Although railroads will often endeavor to make corrective commodity rates if these differences are shown to apply, especially on competitive lines, such new rates are subject to revision or sanction by the Interstate Commerce Commission and adjustments of this nature are becoming more and more difficult to obtain.

On the other hand, wide differences in freight charges for the distribution of finished products often present a different angle, for even with these wide differences the actual unit freight cost may be so small compared to the value of the article as to be absorbed by added efficiency in production.

Markets—Markets are defined as local, favorable, competitive, and national. The local area is the population served by reason of plant location. The favorable area is that which an industry can serve by reason of low-cost production and freight rates. The competitive area is the area in which the industry must compete on equal, or nearly equal, terms with like industries in other localities. The national area is that in which, by reason of certain advantages in fuel, power, or raw materials, an industry expects to compete in spite of adverse freight rates.

The local area is, of course, the most important of these four divisions and should receive the most detailed study. We are convinced of this fact in spite of the usual disregard of the local market by the average industry. Market surveys of numerous regions are listed in our bibliography (see page 440) but if the plant location engineer finds an individual survey necessary, we do not hesitate to recommend for his guidance "An Outline for Market Surveys," by George C. Smith, published by the Industrial Club of St. Louis, 1930.

Production and Distribution Factors

Climate—This factor in selecting the site of a plant is very important and should be thoroughly investigated and compared with the climatic conditions of other sites in order that as few as possible operating difficulties, expenses and hindrances to efficient operation may be encountered. Among the important items of plant operation affected by the climate are: physical comfort of employees, transportation of employees, movement and storage of raw materials, intermediate products, and final products, movement of safety and fire protection equipment, effect on raw materials and products, effect on economical and efficient operation.

Topography—The topography of a proposed plant location is important as affecting the economy and efficiency of the operations, the repairs and maintenance costs of buildings and equipment, and the cost of plant construction. Usually, it is desirable to have the proposed plant site level or with only gentle slopes. However, many chemical and metallurgical operations can afford to pay a premium for hillside sites in order to obtain gravity flow from one operation to the next in the process.

Character of Soil—The character of the soil is important in many ways to the problem of locating a proposed plant. It will have an important influence on the required expenditures for the maintenance, repairs, and rebuilding of the plant, immediately such plant is completed. In many plants, there will be required an extensive system of underground gas and liquid piping, and sewers, which must be laid initially, and repaired and renewed at intervals. The character of the soil will determine largely the magnitude of each such expenditure, which is always expensive and adds appreciable amounts to the production costs without adding to any considerable extent to the profits of the production.

Nuisances and Ordinance Restrictions—Under this general subject may be mentioned: waste disposal, fume nuisances, smoke pollution, and offensive odors. A chemical plant is usually looked upon with suspicion as a potential nuisance maker. The local ordinances should be investigated and studied with great care in order that no existing civic laws are, or might be, violated by the proposed plant. In general, the country location is hampered less by such restrictions than the city location. Waste disposal is a problem that must be kept actively in mind by the plant location engineer.

Direction of Community Growth

The manufacturer must also predict as accurately as is possible the direction of growth of a community and must bear in mind that the proposed plant may become the center of a future district, residential or otherwise, in which the restrictions against nuisances may be more difficult to avoid infringing. If possible, it is desirable so to locate the proposed plant that an existing and permanent obstruction will prevent the undesired expansion of the city's growth. Any district that might easily be improved should be avoided, not only because of increased restrictions against possible nuisances, but also on account of increased taxes.

In an analysis of industry we find that the order of importance of the 12 location factors is often changed, so that what may predominate in one case will be minor in another. It is to be noted, however, that, given favorable fuel and raw material costs, then distribution, favorable freight rates, markets, and labor conditions are the next most important governing factors, as a rule, in the establishment of a basic industry. In the establishment of intermediate industries these same factors become paramount when it has been determined that the industry may obtain, under favorable conditions, those finished products which are its chief raw materials. For tributary industries these same four factors govern without any modifying conditions.

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AND

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NEWS OF THE INDUSTRY

Secretary of the Treasury refused to restore methanol as a denaturant for industrial alcohol. Tubize Chatillon announces indefinite closing of Hopewell rayon plant as result of labor troubles. Accidental injuries in chemical industry last year showed increase in frequency but decrease in severity. Large government loan authorized for naval stores industry.

Texas Gulf Sulphur Buys Sulphur Properties

ANNOUNCEMENT was made on Aug. 2, by the Texas Gulf Sulphur Co., that it has agreed to issue 1,300,000 shares of its stock to the Delaware Gulf Oil Co. for the latter's sulphur interests which were acquired from the Gulf Production Co., subsidiary of Gulf Oil Corp. Texas Gulf will receive 50 per cent interest giving it full ownership in the sulphur deposits at Boling Dome and Long Point, Texas, and will also acquire other valuable sulphur properties and a ten-year option to acquire without additional compensation, all sulphur interests of the Gulf Production Co. in Texas. A special meeting of stockholders of Texas Gulf has been called for Sept. 24 to increase the authorized stock to 3,840,000 shares from 2,540,000 shares and to approve the arrangement.

The sulphur company has been operating these properties for some years under an arrangement with Gulf Production Co. under which it paid for erection of plants and development of the properties from its own funds, and was to be reimbursed for its expenditures out of earnings. When repayment was completed profits from the properties were to be equally divided between Texas Gulf and the Gulf Oil subsidiary.

Since Texas Gulf's own wholly-owned property is nearing exhaustion, under the old arrangement 50 per cent of all future profits from the sulphur business would have been paid to Gulf Oil. Under the new arrangement Texas Gulf gives a 33.85 per cent stock interest in exchange for Gulf Production's 50 per cent share interest future profits.

$6,000,000 Loan Granted for Naval Stores Industry

THE Reconstruction Finance Corp. has made a $6,000,000 commitment to the Commodity Credit Corp. upon the recommendation of the Agricultural Adjustment Administration, for making loans to producers of gum turpentine and gum rosin who are signers of the marketing agreement for the industry. The loans are to be made on warehouse receipts issued by acceptable warehouses and representing gum turpentine and gum rosin of the crop produced in 1934 and within the producers' allotments made under the marketing agreement.

The amount of the loans is placed at $50 per unit, bearing interest at 4 per cent, from which a reserve fund of $10 per unit will be withheld to pay carrying charges and marketing expenses. The loans will be made upon the following basis: 48 cents per gallon for eligible gum turpentine in tanks. For eligible gum rosin the loans are as follows: $4.50 per commercial barrel of 280 pounds for Grade H, or better; $4.25 per commercial barrel for Grades G and F; $4.00 per commercial barrel for Grades E, D and B.

The loans may be made by any bank, cooperative marketing association, factor, or other corporation, partnership, association or person, on eligible gum turpentine and gum rosin warehouse receipts. Loans meeting the requirements of the Commodity Credit Corporation will be purchased by the Corporation from the banks and lending agencies on or before Jan. 1, 1935.

Du Pont Is Building Urea Plant at Belle, W. Va.

ANNOUNCEMENT has been made by E. I. du Pont de Nemours & Co., Inc., Ammonia Department, Wilmington, to the effect that a plant for the manufacture of solid urea is under construction at Belle, W. Va. Shipments will begin about Jan. 1, 1935. This plant will be the first of its kind in this country and will have a capacity sufficient to fill the entire domestic demand for urea. The product, to be called Du Pont Crystal Urea, will be offered in grades suitable for the various technical uses.

Since September, 1932, the du Pont company has manufactured urea-ammonia liquor, a liquid product containing urea and which has attained wide acceptance as an ingredient of mixed fertilizers based on superphosphate. Du Pont Crystal Urea is a logical extension of urea-ammonia liquor manufacture. At present, domestic industry is dependent solely upon Germany for urea supply.

Price schedules and other particulars will be announced in the near future, well in advance of initial production.

Byproduct Sulphuric Acid Production in 1933

ACCORDING to a report issued by the U. S. Bureau of Mines the output of byproduct sulphuric acid at copper and zinc plants in 1933, in terms of 60 deg. acid, amounted to 656,102 short tons, of which 301,075 tons were produced at copper plants and 355,027 tons at zinc plants. At zinc plants, 64,984 tons of sulphur were used to supplement the gases derived from the roasting of zinc blende, and 242,493 tons of sulphuric acid were produced therefrom. No sulphur was used at copper plants.

In 1932, 600,334 tons of byproduct sulphuric acid were produced. Of this amount 258,994 tons were recovered at copper plants and 341,340 tons at zinc plants. Sulphur amounting to 65,510 tons was used at zinc plants for the recovery of 244,644 tons of sulphuric acid.

Tubize Will Not Reopen Hopewell Rayon Plant

ALTHOUGH a settlement is in sight for the dispute between The Tubize Chatillon Co. and its employees, a reopening of the rayon plant at Hopewell, Va., does not appear to be probable. Owing to labor troubles, this plant was closed on June 29 and to date, efforts to bring about an agreement between the company and its employees have not succeeded.

The Labor Relations Board has done much to effect a settlement and the important points at issue appear to be nearing a solution. The most important development of this situation, however, is found in a report that the company will not continue to manufacture rayon at the Hopewell plant.

In the latter part of July, J. E. Bassill, president of The Tubize Chatillon Corp., announced that the sudden abandonment of the plant had caused "not only the ruination of thousands of dollars worth of materials in process, but also tremendous amount of damage to the equipment, due to the corrosion of the chemicals and the solidification of the collodion in pipe lines and spinning pumps."

"Our best estimate of the minimum time required to reopen this plant and secure a satisfactory quality of product would be three months," he added. "This would mean heavy losses through the disposal of inferior product produced during such time at sacrifice prices.

"In reviewing the situation which confronts us with respect to the manufacture of nitrocellulose yarn, and taking into consideration the manner in which this plant was closed, the expense of reopening it, the time involved before a satisfactory quality production can be reached, the stock of yarn on hand, present low selling prices and the relatively high cost of production brought about largely by increased labor and raw material costs, we have reluctantly concluded that our stockholders' interests would not permit the reopening of the plant for the manufacture of yarn.

Survey of World Chemical Markets Released

IMPORTANT developments in the chemical industry during 1933 and the early part of 1934 reflect the spread of world wide economic nationalism and the emergence of Russia and Japan as important factors in the international chemical trade, according to an exhaustive survey covering 27 countries just released by the Chemical Division of the Department of Commerce.

Any presentation of world chemical developments presupposes public recognition of the fact that even in pre-war years the United States was the leader in chemical production and for over a decade has been credited as accounting for approximately half of the world output. United States foreign trade in chemicals, however, up to 1913 was comparatively limited as to expert scope, whereas this country was the world's largest consumer of such imports. While still the largest importer, such requirements are mainly exotic raw materials.

Total world chemical export trade was estimated at $900,000,000 in 1933 despite depreciation of currencies, export restrictions, barter agreements, quotas, and other handicaps to free interchange of goods. Germany ranked first as the largest exporter of chemicals, accounting for nearly one fifth of the total, followed by the United States, United Kingdom, France, Belgium, Netherlands, Switzerland, Italy, Japan, Canada and Spain.

Reviews of developments in all these European countries have been included in the survey as has been the annual custom of the Chemical Division. This year data on other countries which have come to the forefront have been added. Japan, though lacking much in the way of raw materials, has made rapid strides toward self-sufficiency, and Japanese chemicals are establishing strong competition in world markets, for which reasons considerable space has been devoted to a review of developments in that country in this bulletin.

April Chemical Output in Japan Makes Record

OFFICIAL statistics just issued show that the Japanese chemical industry established three new records in production during the month of April, according to a report to the Commerce Department from its Tokyo office. These records were made, the report states, in the production of sulphur, caustic soda and soda ash.

The heavy demand for caustic soda by the paper and rayon industries, the increasing requirements for soda ash by the domestic glass industry and the rising output of sulphuric acid were responsible for the record-breaking production of these items in April, the report points out.

The combined output of eight chemical items including the three above mentioned, superphosphates, sulphate of ammonia, aniline, bleaching powder and cyanamide amounted to 223,970 metric tons during April, compared with 223,929 metric tons during the preceding month and 202,415 metric tons during April, 1933. The aggregate output of these items for the first four months of 1934 amounted to 858,810 metric tons, an increase of about 6 per cent over the corresponding period of 1933.

Accident Report for Chemical Industry

FREQUENCY rates with reference to accidental injuries in chemical plants in 1933 averaged 2 per cent higher than in 1932 — the first rise since 1926 — but severity was 10 per cent below the previous year, according to a survey recently completed by the National Safety Council. These changes are based on the records of 232 companies reporting both years.

The frequency rate is the number of disabling injuries per 1,000,000 manhours of exposure; the severity rate is the number of days lost as the result of disabling injuries, per 1,000 manhours of exposure. A disabling injury is a term applied to any injury arising out of and in the course of employment that results in death, permanent total disability, permanent partial disability or temporary disability.

The 1933 frequency of 10.46 for the chemical industry is lower than the rates for steel, food and automobile plants but slightly higher than for machinery manufacture. On the contrary, however, these industries, with the exception of steel, have lower severity rates than chemical plants.

The 1932-1933 changes in injury rates for the chemical industry compare favorably with results in other groups. The rise of 2 per cent in frequency is considerably less than the increases in the other industries, and with the exception of machinery, chemical plants did much better in severity than the other groups.

As in 1932, large plants had better records than small organizations in frequency but in severity the advantage lies with the small units. The 1933 experience of small plants, in fact, makes a much more favorable comparison than was the case a year ago.

Authority for Dry Color Code Approved

THE National Recovery Administration has announced its approval of the method of selection, and its recognition of the personnel, of the Code Authority for the dry color industry. The members are: A. F. Brown, Imperial Color Works, Glens Falls, N. Y.; J. Allegaert, United Color and Pigment Co., Newark, N. J.; Dr. Max Marx, Max Marx Color and Chemical Co., Irvington, N. J.; L. S. Kohnstamm, H. Kohnstamm and Co., 87 Park Place, New York; Baron Isaacs, Brooklyn Color Works, 129 Cherry St., Brooklyn; O. H. Smith, J. Lee Smith and Co., 23 Jacob St., Brooklyn, and G. A. McCorkle, Krebs Pigment and Color Co., 256 Vanderpool St., Newark, N. J.

NEWS FROM WASHINGTON

By PAUL WOOTON

Washington Correspondent of Chem. & Met.

METHANOL was authorized as a denaturant for completely denatured alcohol in a Treasury decision of August 2. Then on August 9 that authorization was withdrawn, much to the consternation and great cost of both alcohol and methanol producers.

The first order was intended to restore the old CD No. 1 formula which was suspended in January, 1931 by Commissioner J. M. Doran. The principal cause of the suspension was the demand that "poison alcohol" be eliminated from bootleg-diverted industrial alcohol. The pressure in that direction was, of course, relieved by repeal, though the quantity of bootleg liquor consumed is said still to be just as great as ever. Then suddenly this poison alcohol spectre rises again and causes the new difficulty of August 9.

Treasury officials refuse a formal explanation as to why the secretary changes his mind within the week. Most likely is the theory that he heard popular protest among those who like cheap bootleg liquor and mistook it for adequate and reasonable public objection. Only a little less likely is the theory that protests of this sort were heard aboard the Presidential train in the Middle West and a request for postponement of action came from there to the Treasury.

The restoration of the formula came as a result of a request from the committee of industrial alcohol producers, distributors, and users. This group found from practical experience that alcohol was losing business to other solvents and asked that a less odorous, usable formula be authorized. Producers of natural methanol were, of course, enthusiastic about this idea because it restored to them a large prospective market for this wood chemical.

Opposition to methanol as a denaturant was offered at the hearings principally by a spokesman of the duPont organization who presented a prepared statement favoring the requirement that Pontol be included in all formulas. That idea, however, was objectionable to all other interested groups participating in this conference, as they blame Pontol and the related denaturants for the highly objectionable odors which they allege have caused a shrinkage in the total completely denatured-alcohol market. The Treasury Department apparently did not accept the duPont theory.

It was expected that the new formula would require 10 parts of denaturing grade methanol and one-half part approximately of benzine or kerosene per 100 parts of alcohol. On that basis, the consumption during the coming year of methanol denaturant would be about four times that last year. Some feared a shortage. For this reason there was considerable official support for the idea that synthetic methanol properly compounded might be used instead. This would, it is believed, not seriously interfere with the natural methanol market, but would ensure for the alcohol industry adequate supplies and prevent any runaway in methanol prices.

Synthetic methanol may perhaps thus become eligible for use as a denaturant, just as soon as does natural. It is proposed that those making this synthetic product submit samples of any denaturing-grade which they desire to have authorized for use. Such a compounded mixture containing suitable proportions of ketones, esters, etc., will be considered by the Treasury on the request of its proponents. To be satisfactory it must meet not only laboratory tests that are customary. It also must demonstrate on a large-scale basis a resistance to the cleaning methods customary in bootleg manipulation.

Oxides of Iron

The President has approved the final findings of the Tariff Commission in an investigation, for the purposes of section 337 of the Tariff Act of 1930, of alleged unfair methods of competition or unfair acts in the importation or sale of oxides of iron suitable for pigment purposes. At the same time, he directed the Secretary of the Treasury to instruct customs officers to exclude from entry oxides of iron produced in the manner specified in the two patents for which the complainant is the sole and exclusive licensee to manufacture and to sell within that portion of the United States east of the States of Montana, Wyoming, Colorado, and Texas. The patents are the property of the West Coast Kalsomine Co., a California corporation. This, in effect, makes final the temporary order of exclusion, except under bond, issued on March 2, 1933, by the President.

The Tariff Commission instituted the investigation on complaint of the Magnetic Pigment Co. of New York. Those named as respondents in the complaint were a Canadian manufacturer, a Canadian distributor, and two New York importers. In addition to the findings that the patented processes were used in making the imported merchandise, it was found that the sales of the imported article made by these processes substantially injured the domestic industry.

Upon completion of the investigation the findings were sent to parties of record in accordance with the provisions of the law. Within the prescribed time there was filed in the Court of Customs and Patent Appeals, also in accordance with the law, an appeal for a review of questions of law involved in the Commission's findings. In May that court rendered a decision affirming the Commission's findings in the investigation.

Export Financing

Government plans for financing foreign trade—except that with Russia—were announced on the eve of the study of the Russian debt situation in Washington. The facilities of the government "Export-Import Banks" are now open for the use of American exporters. The job was done by expanding the field of the Second Bank, originally set up for Cuba, to the whole world, leaving the First Bank, which was set up for Russian trade, waiting until the debt settlement is made, for under the bank's resolution in connection with the Johnson bill prohibiting Americans from doing business with countries in default on their government debts to this government, Russia cannot be helped, even indirectly until the debts are arranged. That job is now going forward in Washington, recently transferred from Moscow.

The Second Bank, as now set up, can do every banking job, from letters of credit to rediscount, and exporters and importers may apply either direct or through any commercial bank for this government assistance. Three kinds of credit will be available: up to 6 months, up to 1 year, up to 5 years—the latter called "long term credits." The latter alone are looked on, at the government bank, as outside present facilities, and the plan is so scaled as to bring the commercial banks into the picture to the greatest extent possible. The bank will collect ¾ per cent over what it pays the RFC for its money (4 per cent) on the first two types of loans, and 1 per cent on the "long term" credits.

The credit guarantee plan is brief but clear. It will be given primarily to deals in "fabricated articles," and will cover up to 75 per cent of the total credit or net delivered cost, whichever is lower, at the rate of 4 per cent for the first year, and 2 per cent for each year thereafter; commercial banks and other financial institutions may participate in this business.

Germany Develops Processes for Motor Fuel Production

AS THE problem of motor fuel supply still is the question holding great interest to German technologists this subject will again be discussed in connection with a recent address by Dr. Heinrich Koppers, of Essen. Low-temperature carbonization which had made tremendous progress during the War and the post-war period had practically come to a standstill in Germany in 1929, because the products made could not compete in quality or in quantity, with petroleum and hydrogenation products, and because the quantity of coke produced—about 80 per cent of the coal used—could not be marketed in Germany. However, renewed efforts are being made at the present time, for several reasons, the most important among which is the economic advantage of producing motor fuels from domestic raw materials to the greatest possible extent. The present idea is, as far as possible, to convert the carbonaceous part of the coal into solid liquid, and gaseous motor fuel. The liquid products are used as gasoline and diesel fuel, the gaseous as city gas or as compressed cylinder gas, while new fields must be found for the coke, for instance, gasification — in the original state or in briquets—in generators for gas-oil synthesis, but particularly in generators for motor vehicles. Very important technical developments are now under way in this direction.

Koppers introduces a new process and a new concept; in addition to the high-temperature and the low-temperatures carbonization methods he presents the intermediate-temperature carbonization, operated since 1931 in Bruay, where 480 tons is being treated daily, and by Compagnie Generale Industrielle á Carmaux. Other plants of the same type are under construction in England and in Turkey, so that plants with an annual capacity of about 350,000 tons of coal will soon be using the Koppers process.

The intermediate-temperature distillation process differs from most low-temperature processes in the respect that brick ovens, as used in modern coke plants, have replaced the iron retorts. Koppers found that the temperature of the iron retorts drops from 600 deg. C. to 300-350 deg. C. during charging, that the iron in the retorts is consequently repeatedly subjected to considerable temperature variations. He also criticized the relatively small dimensions of the retorts compared with the coke ovens, which combine large capacities per unit with almost unlimited durability. The gases and vapors produced in the brick ovens may furthermore be subjected to a subsequent thermal treatment in the furnace itself, in an atmosphere of hydrogen; the process using intermediate temperatures thus offers the possibility of direct manufacture of marketable products. If the distillation products are added in the hydrogenation then the subsequent treatment in the furnace may be dispensed with and the gases and vapors are drawn off in their original state. In carbonization at intermediate temperature these gases and vapors, which are given off by the coal at the same temperatures as in the low-temperature hydrogenation, do not become materially changed during their passage through the coal, as the temperature of the inner walls of the oven drops when the cold coal is added, in the same manner as in low-temperature carbonization, while on the other hand the temperature on the hot side remains practically constant. This change in temperature does not destroy brick work. Finally, the heat consumption in the distillation in coke ovens is lower than in low-temperature carbonization, on account of the regenerative system used, so that an excess of gas is always available after the gas requirement for heating has been taken care of. The present investment in coke ovens may be utilized in the process using intermediate temperature, as the present coke plants may be converted with comparatively small expenditures. Thus a development of the new process will furnish considerable spare equipment for the coking industry, as during a crisis with extra heavy demand for coke these ovens may produce high-temperature coke simply by raising the distillation temperature.

Method of Distillation

The distillation takes place in horizontal ovens at a temperature of 600-700 deg. C. at the inside wall. The average width of the ovens is 250-350 mm., the daily capacity of such a unit of normal dimensions is 10-20 tons, according as charging is done once or twice. With many types of coal this width and temperature are sufficient to produce a good fuel, after proper mechanical preparation. With coals high in bitumen, however, natural or artificial means to offset the high bitumen content must be applied. This can be done by addition of pulverized lean coal or by subjecting the coal to a preliminary treatment in revolving drums. Such drums have been built for a daily capacity of 60-70 tons, and they last almost indefinitely.

After completion of the treatment the coal is loose in the oven and is pressed out with the usual type of machine into a quenching cart. On account of its toughness practically no dust is formed when it is crushed. The thermal characteristics of this new fuel, such as content of volatile matter, point of ignition, and electrical conductivity (a criterion for the degree of graphiteization) are in no way inferior to those of regular distillation coke. The properties are also said to be independent of the type of coal used. To prove this, coke was made from the most different types of coal with volatile content varying from 20 to 40 per cent, without any change in the quality being found. The by-products may be obtained directly in marketable form when they are subjected to a gentle decomposition and hydrogenation in the oven itself, whereby certain chemical changes occur which make them more valuable. The tar is characterized by a particularly high content of oils and contains valuable phenols from which at Bruay is obtained crystallized phenol, the three cresols, as well as xylenols. The neutral oils may also find application as diesel oils. In Bruay is also obtained 1.1 per cent of a light knockless motor fuel. The economic advantage of the process may be attributed to the fact that the proceeds from the byproducts are greater than the operating costs, including interest and amortization on the capital investment.

CALENDAR

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY, fall meeting, Portland, Ore., Sept. 10-13.

AMERICAN CHEMICAL SOCIETY, fall meeting, Cleveland, Sept. 10-14.

ELECTROCHEMICAL SOCIETY, fall meeting, New York, Sept. 27-29.

PAINT, VARNISH AND LACQUER ASSOCIATION, annual meeting, Washington, D. C., Oct. 31 to Nov. 3.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, fall meeting, Pittsburgh, Nov. 15-17.

NATIONAL EXPOSITION OF POWER, Grand Central Palace, New York, Dec. 3-8.

NAMES IN THE NEWS

William H. Bassett, Sr.

Harry C. Peffer

D. A. PRITCHARD, formerly production manager of the chemical group of Canadian Industries, Ltd., has been appointed manager of the chemical group technical department.

WILLIAM A. NEILL has resigned from The Dorr Co. to engage in consulting engineering practice. He will continue to serve Dorr.

FERDINAND F. E. KOPECKY formerly with the Bakelite Co. is now associated with Thomas & Hochwalt Laboratories, Dayton, Ohio.

P. D. PETERSON, plant pathologist, has joined the technical staff of Freeport Sulphur Co., and RALPH L. MILLER, entomologist, has become associated with the same company.

FREDERICK R. BACHLER, formerly chief chemist of the American Beet Sugar Co., has been advanced to general chemist and moved to headquarters at Denver.

J. S. LONG, professor of chemistry at Lehigh University, has resigned to become chemical director of Devoe & Raynolds Co.

AARON E. CARPENTER has been elected president and general manager of E. F. Houghton & Co. MAJOR CARPENTER represents the third generation of Carpenters to occupy the presidency.

B. I. THORNGREN has been appointed sales engineer by the Maintenance Engineering Corp., Houston, Texas.

FRANK C. RYAN, who has previously been with John Manville & Co., has been engaged for technical sales and development work by General Asbestos & Rubber Division of Raybestos-Manhattan Inc., North Charleston, W. Va.

HARLOWE HARDINGE, vice-president and general manager of Hardinge Co., has returned from a business trip to Europe.

ROBERT J. MOORE and W. D. TURNER have been elected chairman and vice-chairman respectively of the American Section of the Society of Chemical Industry.

L. F. WAREK, formerly acting director of the Research Laboratory of Applied Chemistry at M.I.T., has joined the staff of Arthur D. Little, Inc., Cambridge, Mass.

J. E. ARCHER, a graduate in chemistry from Michigan State College, has been added to the staff of Battelle Memorial Institute of industrial and scientific research, Columbus.

L. M. AYCOCK, formerly with the Swann Corp., has joined the technical sales staff of American Potash & Chemical Co., New York.

JAMES D. RANSOM, formerly with Columbus Coated Fabrics Corp., has joined Woburn Degreasing Co. of Kearny, N. J.

A. E. TIESLER has joined the Calco Chemical Co. at Bound Brook, N. J.

OBITUARY

WILLIAM H. BASSETT, SR., metallurgical manager of the American Brass Co., died at his home in Cheshire, Conn., on July 21. He was 66 years of age.

Dr. Bassett was a founder member and a former director of the American Institute of Chemical Engineers. He was a past-president of the American Institute of Mining and Metallurgical Engineers and was recently elected president of the American Society for Testing Materials.

After graduating from M.I.T., Dr. Bassett became a chemist with the Popes Island Manufacturing Co. In 1900 he was appointed chief chemist at the Newark works of the New Jersey Zinc Co. Two years later he joined the Coe Brass Manufacturing Co. as chemist. The next year he was made chief chemist and metallurgist for the American Brass Co.

HARRY C. PEFFER, who has been head of the School of Chemical Engineering at Purdue University from its inception in 1911, dropped dead from heart failure July 17.

Professor Peffer was born at Enon Valley, Pa., Aug. 15, 1873, and he later attended Pennsylvania State College. He was a member of the Board of Management of the Purdue Engineering Experimental Station. During the War he served as organization manager of U. S. Explosive Plant C. in West Virginia, and for one year following was a member of the Indiana Gas Standard Commission.

He is the holder of patents on chemical and industrial processes, building materials, mechanical devices and welding. He was interested in aluminum compounds all of his life. He not only worked with the Aluminum Company of America, but during the past ten years devoted much of his research interest to alumino-silicates and their application to the manufacture of an artificial product known as Rostone.

GEORGE V. SHEFFIELD, vice-president and treasurer of Innis, Speiden & Co., died July 19, after a brief illness.

L. W. HOTETTLER, alloy sales manager of Allegheny Steel Co., died July 10 in St. Theresse Hospital, Waukegan, Ill.

WALTON CLARK died at his home in Chestnut Hill, Philadelphia, on July 30 after a long illness. He was in his seventy-ninth year. Dr. Clark achieved prominence in the gas industry and for 17 years was president of the Franklin Institute.

HENRY ARNSTEIN was claimed by death on July 24 at Mt. Sinai Hospital, Philadelphia, after an illness of five weeks. Dr. Arnstein founded the international consulting firm of Arnstein Engineering Co. which has conducted many investigations for several of the South American governments.

MARKETS

Reduced activities in large consuming industries resulted in a drop in contract withdrawals of basic chemicals during last month. Price changes while not numerous favor buying side of market. Competition in potash salts continue to attract attention. European producers of nitrogen reported to have formed new international agreement which includes Chilean nitrate interests.

FOLLOWING a slowing up in productive activities on the part of different industries which are large consumers of chemicals, the movement of raw materials has been retarded. Not only has there been a drop in spot buying of chemicals but disappointment also has been expressed because of the failure of contract holders to order out July and August deliveries in accordance with contract terms.

Naturally the slower contract movement has resulted in some stock accumulations at producing points which in turn has influenced a slower rate of production.

The Atlantic States Shippers' Advisory Board in forecasting shipments for the third quarter of this year, anticipated a gain of 5.64 per cent in the movement of all commodities, 10 per cent for petroleum and petroleum products, 10 per cent for fertilizer, and 2.7 per cent for chemicals. The comparison is with the third quarter of last year.

Favorable reports have continued to come from the paint and varnish trade and sales of paint, varnish, and lacquer products in June were valued at $28,794,352, as compared with $27,813,233 for June, 1933, and $19,637,358 for June, 1932. Production of sulphuric acid in the fertilizer trade also has held up well, the total for June being 92,894 tons against 76,530 tons for June, 1933, and 44,930 tons for June, 1932.

The situation surrounding potash salts has not changed for the better. At the beginning of the month representatives of foreign producers announced a lower price schedule which placed the foreign material on an equal price level with domestic material.

The use of wood alcohol as a denaturant in the formula for completely denatured alcohol, was authorized on Aug. 2 by Guy T. Helvering, Commissioner of Internal Revenue. This decision was cancelled by a later announcement which read that authorization for the use of methanol as a denaturant in the formula for completely denatured alcohol would not be given at this time and that the whole matter in question had been postponed indefinitely.

The restoration of methanol as a denaturant would have considerable market significance, as it would mean a broader market for this product and no doubt would encourage a larger production.

Mills in the United States which crushed flaxseed during the quarter ended June 30 reported a crush of 140,462 tons and a production of 98,026,013 lb. of linseed oil, the Bureau of Census announces.

These totals compare with 119,508 tons of seed crushed and 79,034,580 lb. of oil produced in the corresponding quarter of 1933.

Stocks of flaxseed at the mills on June 30, this year, totaled 39,780 tons, compared with 23,901 tons for the same date last year. Stocks of linseed oil reported by the crushers amounted to 90,882,823 lb. on June 30, against 59,191,846 lb. on the same date in 1933.

Reports from Canada state that Russia has been selling potash at low prices in the Dominion. Arrivals in Canada are expected early in September and the prices are said to be about $20 a ton under those paid for deliveries in the past season.

The position of tanning materials has improved as a result of a plan for withholding of government hides from the market until after the peak of the drought and crop reduction killings, and their subsequent gradual and orderly marketing, which was presented to the tanning industry of the United States at simultaneous meetings held in Boston and Chicago, and received the unanimous approval of the industry.

A committee is completing arrangements which assure the organization of a corporation by tanners to take the responsibility of the orderly marketing of these hides and skins on the basis of 9 cents per pound for light native cow hides.

An agreement is reported to have been reached in Paris between representatives of the Chilean nitrate industry and producers of synthetic nitrogen to form a world cartel in order to avoid price wars.

Chilean nitrate has been offering keen competition to synthetic production in world markets as reflected by the expansion in Chilean exports in the year ended June 30, 1934, to 1,162,000 tons, from only 228,000 tons in the previous fiscal year. The reorganization of the Chilean industry and reduction in its capital structure, as well as Chile's trade policy of releasing frozen foreign debts and making compensatory trade agreements with various European countries, have considerably improved the competitive position of Chilean nitrate.

CHEM. & MET.

Weighted Index of CHEMICAL PRICES

Base = 100 for 1927

This month	**87.61**
Last month	87.79
August, 1933	86.26
August, 1932	84.53

The more important chemicals held a steady price position. Changes in other groups were not important, but in the main favored buyers and the weighted index number again dropped slightly.

CHEM. & MET.

Weighted Index of Prices for OILS AND FATS

Base = 100 for 1927

This month	**62.97**
Last month	60.54
August, 1933	64.98
August, 1932	43.41

Strength in grains has favored higher prices for animal fats with a continued rising curve probable. Cottonseed oil also was sharply advanced with paint-making oils showing but little change.

CURRENT PRICES

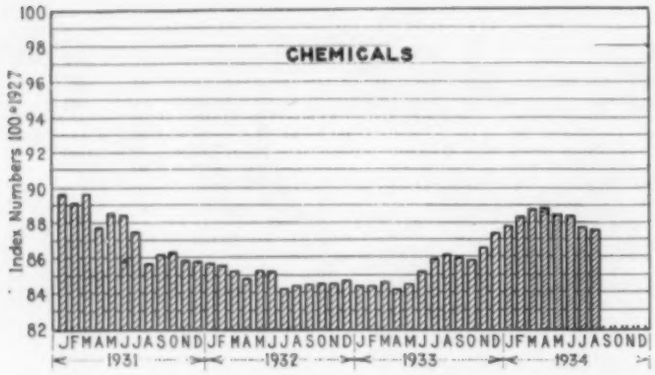
The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Aug. 13.

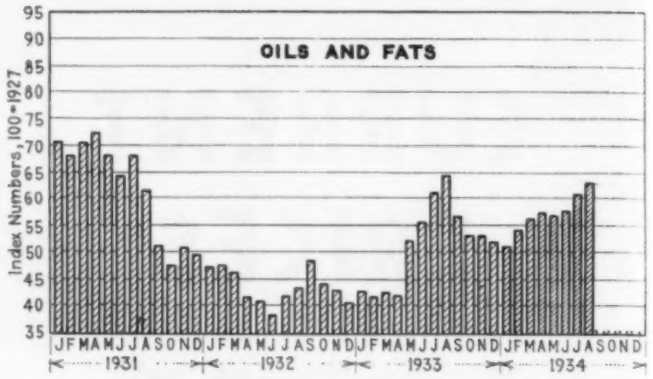
Industrial Chemicals

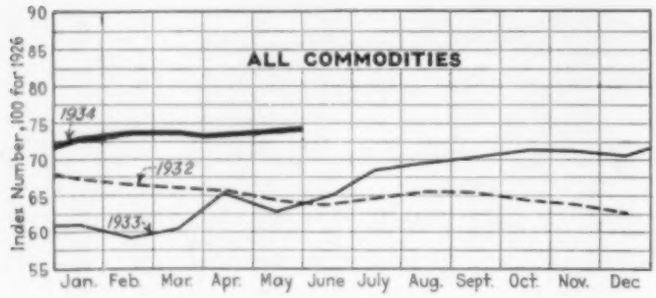
	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.11 -$0.11½	$0.11 -$0.11½	$ .08½-$0.09
Acid, acetic, 28%, bbl., cwt.	2.76 - 2.90	2.76 - 2.90	2.90 - 3.15
Glacial 99%, drums	9.13 - 9.38	9.13 - 9.38	10.02 - 10.27
U. S. P. reagent, c'bys.	10.52 -10.77	10.52 -10.77	10.52 -10.77
Boric, bbl., lb.	.04½- .05	.04½- .05	.04½- .05
Citric, kegs, lb.	.28 - .31	.28 - .31	.29 - .31
Formic, bbl., lb.	.11 - .11½	.11 - .11½	.10½- .11
Gallic, tech., bbl., lb.	.60 - .65	.60 - .65	.60 - .65
Hydrofluoric 30% carb., lb.	.07 - .07½	.07 - .07½	.06 - .07
Latic, 44%, tech., light, bbl., lb.	.11½- .12	.11½- .12	.11½- .12
22%, tech., light, bbl., lb.	.06 - .06½	.05½- .06	.05½- .06
Muriatic, 18° tanks, cwt.	1.00 - 1.10	1.00 - 1.10	1.00 - 1.10
Nitric, 36°, carboys, lb.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks., ton	18.50 -20.00	18.50 -20.00	18.50 -20.00
Oxalic, crystals, bbl., lb.	.11½- .12½	.11½- .12½	.11 - .12
Phosphoric, tech., c'bys., lb.	.09 - .10	.09 - .10	.08½- .09
Sulphuric, 60°, tanks, ton	11.00 -11.50	11.00 -11.50	11.00 -11.50
Sulphuric, 66°, tanks, ton	15.50 -.....	15.50 -.....	15.50 -.....
Tannic, tech., bbl., lb.	.23 - .35	.23 - .35	.23 - .35
Tartaric, powd., bbl., lb.	.26 - .26½	.26 - .26½	.23 - .24
Tungstic, bbl., lb.	1.40 - 1.50	1.40 - 1.50	1.40 - 1.50
Alcohol, Amyl	.....	.....	.....
From Pentane, tanks, lb.	.143-.....	.143-.....	.15-.....
Alcohol, Butyl, tanks, lb.	.095-.....	.095-.....	.095-.....
Alcohol, Ethyl, 190 p'f., bbl., gal	4.15½-.....	4.15½-.....	2.53½-.....
Denatured, 190 proof	.....	.....	.....
No. 1 special, dr., gal.	.346-.....	.346-.....	.34½-.....
No. 5, 188 proof, dr., gal.	.34 -.....	.34 -.....	.34 -.....
Alum, ammonia, lump, bbl., lb.	.03 - .04	.03 - .04	.03 - .04
Chrome, bbl., lb.	.04½- .05	.04½- .05	.04½- .05
Potash, lump, bbl., lb.	.03 - .04	.03 - .04	.03 - .04
Aluminum sulphate, com., bags cwt.	1.35 - 1.50	1.35 - 1.50	1.25 - 1.40
Iron free, bg., cwt.	1.90 - 2.00	1.90 - 2.00	1.90 - 2.00
Aqua ammonia, 26°, drums lb.	.02½- .03	.02½- .03	.02½- .03
tanks, lb.	.02½- .02¾	.02½- .02¾	.02½- .02¾
Ammonia, anhydrous, cyl., lb.	.15½- .16	.15½- .16	.15½- .15¾
tanks, lb.	.04½-.....	.04½-.....	.05 -.....
Ammonium carbonate, powd tech., casks, lb.	.08 - .12	.08 - .12	.08 - .12
Sulphate, wks., cwt.	1.25 -.....	1.25 -.....	1.10 -.....
Amylacetate tech., tanks, lb., gal	.142-.....	.142-.....	.142-.....
Antimony Oxide, bbl., lb.	.08½- .09	.08½- .09	.07½- .08
Arsenic, white, powd., bbl., lb.	.04 - .04½	.04 - .04½	.04 - .04½
Red, powd., kegs, lb.	.15 - .15½	.15 - .15½	.13 - .14
Barium carbonate, bbl., ton	56.50 -58.00	56.50 -58.00	56.50 -58.00
Chloride, bbl., ton	74.00 -75.00	74.00 -75.00	63.00 -65.00
Nitrate, cask, lb.	.08½- .09	.08½- .09	.07½- .07¾
Blanc fixe, dry, bbl., lb.	.03½- .04	.03½- .04	.03½- .04
Bleaching powder, f.o.b., wks., drums, cwt.	1.85 - 2.00	1.85 - 2.00	1.75 - 2.00
Borax, grain, bags, ton	40.00 -45.00	40.00 -45.00	40.00 -45.00
Bromine, cs., lb.	.36 - .38	.36 - .38	.36 - .38
Calcium acetate, bags	2.50 -.....	2.50 -.....	3.00 -.....
Arsenate, dr., lb.	.05 - .07	.05 - .07	.07 - .08
Carbide drums, lb.	.05 - .06	.05 - .06	.05 - .06
Chloride, fused, dr., wks., ton.	17.50 -.....	17.50 -.....	17.50 -.....
flake, dr., wks., ton.	19.50 -.....	19.50 -.....	19.50 -.....
Phosphate, bbl., lb	.07½- .08	.07½- .08	.07½- .08
Carbon bisulphide, drums, lb.	.05½- .06	.05½- .06	.05½- .06
Tetrachloride drums, lb.	.05½- .06	.05½- .06	.05½- .06
Chlorine, liquid, tanks, wks., lb.	.0185-.....	.0185-.....	.01 -.....
Cylinders	.05½- .06	.05½- .06	.05½- .06
Cobalt oxide, cans, lb.	1.35 - 1.40	1.35 - 1.40	1.15 - 1.25
Copperas, bgs., f.o.b. wks., ton.	14.00 -15.00	14.00 -15.00	14.00 -15.00
Copper carbonate, bbl., lb.	.08½- .16	.08½- .16	.08½- .16
Cyanide, tech., bbl., lb.	.37 - .38	.37 - .38	.39 - .44
Sulphate, bbl., cwt.	3.85 - 4.00	3.85 - 4.00	3.75 - 4.00
Cream of tartar, bbl., lb.	.19½- .20	.19½- .20	.16½- .17
Diethylene glycol, dr., lb.	.14 - .16	.14 - .16	.14 - .16
Epsom salt, dom., tech., bbl., cwt	2.10 - 2.15	2.10 - 2.15	1.70 - 2.00
Imp., tech., bags, cwt.	2.00 - 2.10	2.00 - 2.10	1.35 - 1.40
Ethyl acetate, drums, lb.	.08½-.....	.08½-.....	.08¾-.....
Formaldehyde, 40%, bbl., lb.	.06 - .07	.06 - .07	.06 - .07
Furfural, dr., contract, lb.	.10 - .17½	.10 - .17½	.10 - .17½
Fusel oil, crude, drums, gal.	.75 -.....	.75 -.....	.75 -.....
Refined, dr., gal.	1.25 - 1.30	1.25 - 1.30	1.25 - 1.30
Glaubers salt, bags, cwt.	1.00 - 1.10	1.00 - 1.10	1.00 - 1.10
Glycerine, c.p., drums, extra, lb.	.13½- .14	.13½- .14	.10½- .10¾
Lead:			
White, basic carbonate, dry casks, lb.	.06½-.....	.06½-.....	.06½-.....
White, basic sulphate, sck., lb.	.06 -.....	.06 -.....	.06 -.....
Red, dry, sck., lb.	.06½-.....	.06½-.....	.08 -.....
Lead acetate, white crys., bbl., lb.	.10½- .11	.10½- .11	.10½- .11
Lead arsenate, powd., bbl., lb.	.07 - .09	.09 - .13	.09 - .13
Lime, chem., bulk, ton	8.50 -.....	8.50 -.....	8.50 -.....
Litharge, pwd., csk, lb.	.05½-.....	.05½-.....	.07 -.....
Lithophone, bags, lb.	.04½- .05	.04½- .05	.04½- .05
Magnesium carb., tech., bags, lb.	.06 - .06½	.06 - .06½	.05½- .06
Methanol, 95%, tanks, gal.	.33 -.....	.33 -.....	.33 -.....
97%, tanks, gal.	.34 -.....	.34 -.....	.34 -.....
Synthetic, tanks, gal.	.35½-.....	.35½-.....	.35½-.....
Nickel salt, double, bbl., lb.	.11½- .12	.11½- .12	.12 - .12½
Orange mineral, csk., lb.	.09½-.....	.09½-.....	.10½-.....
Phosphorus, red, cases, lb.	.45 - .46	.45 - .46	.45 - .46
Yellow, cases, lb.	.28 - .32	.28 - .32	.28 - .32
Potassium bichromate, casks, lb.	.07½- .08½	.07½- .08½	.07½- .08
Carbonate, 80-85%, calc. csk., lb	.07 - .07½	.07 - .07½	.06½- .07
Chlorate, powd., lb.	.09½- .10	.09½- .10	.08 - .08½
Hydroxide (caustic potash) dr., lb.	.07½- .07½	.07½- .07½	.07½- .07½
Muriate, 80% bgs., ton	22.00 -.....	31.90 -.....	37.15 -.....
Nitrate, bbl., lb.	.05½- .06	.05½- .06	.05½- .06
Permanganate, drums, lb.	.1 - .19	.18½- .19	.16 - .16½
Prussiate, yellow, casks, lb.	.18 - .19	.18 - .19	.16½- .17
Sal ammoniac, white, casks, lb.	.04½- .05	.04½- .05	.04½- .05
Salsoda, bbl., cwt.	1.00 - 1.05	1.00 - 1.05	.90 - .95
Salt cake, bulk, ton	13.00 -15.00	13.00 -15.00	13.00 -15.00
Soda ash, light, 58%, bags, contract, cwt.	1.23 -.....	1.23 -.....	1.20 -.....
Dense, bags, cwt.	1.25 -.....	1.25 -.....	1.22½-.....
Soda, caustic, 76%, solid, drums, contract, cwt.	2.60 - 3.00	2.60 - 3.00	2.50 - 2.75
Acetate, works, bbl., lb.	.04½- .05	.04½- .05	.04½- .05
Bicarbonate, bbl., cwt.	1.85 - 2.00	1.85 - 2.00	1.85 - 2.00
Bichromate, casks, lb.	.05½- .06½	.05½- .06½	.05½- .05½
Bisulphate, bulk, ton	14.00 -16.00	14.00 -16.00	14.00 -16.00
Bisulphite, bbl., lb.	.03 - .04	.03 - .04	.03½- .04
Chlorate, kegs, lb.	.06½- .06½	.06½- .06½	.05½- .07½
Chloride, tech., ton	12.00 -14.75	12.00 -14.75	12.00 -14.00
Cyanide, cases, dom., lb.	.15½- .16	.15½- .16	.15½- .16
Fluoride, bbl., lb.	.07½- .08	.07½- .08	.07 - .08
Hyposulphite, bbl., lb.	2.40 - 2.50	2.40 - 2.50	2.40 - 2.50
Metasilicate, bbl., cwt.	3.25 - 3.40	3.25 - 3.40	3.25 - 3.40
Nitrate, bags, cwt.	1.35 -.....	1.35 -.....	1.295-.....
Nitrite, casks, lb.	.07½- .08	.07½- .08	.07½- .08
Phosphate, dibasic, bbl., lb.	.021- .023	.021- .023	.02 - .023
Prussiate, yel. drums, lb.	.11½- .12	.11½- .12	.11½- .12
Silicate (40° dr.) wks cwt.	.80 - .85	.80 - .85	.80 - .85
Sulphide, fused, 60-62%, dr., lb.	.02½- .03½	.02½- .03	.02½- .03
Sulphite, cyrs., bbl., lb.	.02½- .02½	.02½ .02½	.03 - .03½
Sulphur, crude at mine, bulk, ton	18.00 -.....	18.00 -.....	18.00 -.....
Chloride, dr., lb.	.03½- .04	.03½- .04	.03½- .04
Dioxide, cyl., lb.	.07 - .07½	.07 - .07½	.06½- .07
Flour, bag, cwt.	1.60 - 3.00	1.60 - 3.00	1.55 - 3.00
Tin Oxide, bbl. lb.	.56 -.....	.56 -.....	.50 -.....
Crystals, bbl., lb.	.38½-.....	.38½-.....	.36½-.....
Zinc chloride, gran., bbl., lb.	.05½- .06	.05½- .06	.06½- .06½
Carbonate, bbl., lb.	.09½- .11	.09½- .11	.10½- .11
Cyanide, dr., lb.	.38 - .42	.38 - .42	.38 - .42
Dust, bbl., lb.	.07 - .07½	.07 - .07½	.06½- .07
Zinc oxide, lead free, bag, lb.	.06½-.....	.06½-.....	.05½-.....
5% lead sulphate, bags, lb.	.06½-.....	.06½-.....	.05½-.....
Sulphate, bbl., cwt.	3.00 - 3.25	3.00 - 3.25	3.00 - 3.25

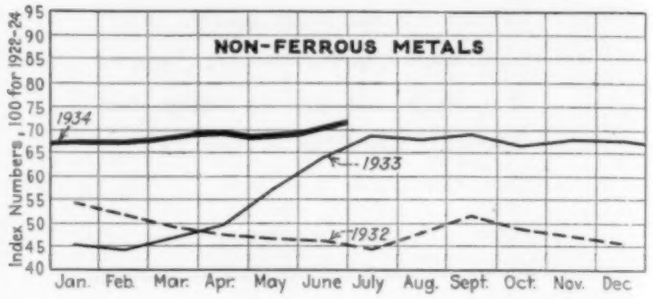
Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.09½-$0.10	$0.09½-$0.10	$0.09½-$0.10
Chinawood oil, bbl., lb.	.09 -.....	.09½-.....	.08 -.....
Coconut oil, Ceylon, tanks, N. Y. lb.	.02½-.....	.02½-.....	.03½-.....
Corn oil crude, tanks, (f.o.b. mill), lb	.05½-.....	.05½-.....	.05½-.....
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.05½-.....	.04½-.....	.03½-.....
Linseed oil, raw car lots, bbl., lb.	.097-.....	.097-.....	.104-.....
Palm, Lagos, casks, lb.	.03½-.....	.03½-.....	.04½-.....
Palm Kernel, bbl., lb.	.03½-.....	.03½-.....	.04½-.....
Peanut oil, crude, tanks (mill), lb.	.05½-.....	.05½-.....	.05½-.....
Rapeseed oil, refined, bbl., gal.	.37 - .38	.37 - .38	.65 - .68
Soya bean, tank, lb.	.06½-.....	.06½-.....	.....-.....
Sulphur (olive foots), bbl., lb.	.07½-.....	.07½-.....	.03½-.....
Cod, Newfoundland, bbl., gal.	.40 -.....	nom.	nom.
Menhaden, light pressed, bbl., lb.	.051-.....	.051-.....	.053-.....
Crude, tanks (f.o.b. factory), gal.	.18 -.....	.16 -.....	.17 -.....
Grease, yellow, loose, lb.	.03½-.....	.03½-.....	.03½-.....
Oleo stearine, lb.	.06½-.....	.05½-.....	.06 -.....
Red oil, distilled, d.p. bbl., lb.	.07 -.....	.07 -.....	.06½-.....
Tallow, extra, loose, lb.	.04½-.....	.03½-.....	.03½-.....









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl., lb.	.80 - .85	.80 - .85	.80 - .85
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb.	.14½- .15	.14½- .15	.14½- .15
Aniline salts, bbl., lb.	.24 - .25	.24 - .25	.24 - .52
Benzaldehyde, U.S.P., dr., lb.	1.10 - 1.25	1.10 - 1.25	1.10 - 1.25
Benzidine base, bbl., lb.	.65 - .67	.65 - .67	.65 - .67
Benzoic acid, U.S.P., kgs, lb.	.48 - .52	.48 - .52	.48 - .52
Benzyl chloride, tech., dr., lb.	.30 - .35	.30 - .35	.30 - .35
Benzol, 90% tanks, works, gal.	.19 - .20	.19 - .20	.22 - .23
Beta-naphthol, tech., drums, lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U. S. P., dr., lb.	.11 - .11½	.11 - .11¼	.10½- .11
Cresylic acid, 97%, dr., wks., gal.	.50 - .51	.50 - .51	.45 - .46
Diethylaniline, dr., lb.	.55 - .58	.55 - .58	.55 - .58
Dinitrophenol, bbl., lb.	.29 - .30	.29 - .30	.29 - .30
Dinitrotoluen, bbl. lb.	.16 - .17	.16 - .17	.16 - .17
Dip oil 25% dr., gal.	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, bbl., lb.	.38 - .40	.38 - .40	.38 - .40
H-acid, bbl., lb.	.65 - .70	.65 - .70	.65 - .70
Naphthalene, flake, bbl., lb.	.06 - .07	.06 - .07	.04½- .05
Nitrobenzene, dr., lb.	.08½- .09	.08½- .09	.08½- .10
Para-nitraniline, bbl., lb.	.51 - .55	.51 - .55	.51 - .55
Phenol, U.S.P., drums, lb.	.14½- .15	.14½- .15	.14½- .15
Picric acid, bbl., lb.	.30 - .40	.30 - .40	.30 - .40
Pyridine, dr., gal.	1.10 - 1.15	1.10 - 1.15	.90 - .95
Resorcinal, tech., kegs, lb	.65 - .70	.65 - .70	.65 - .70
Salicylic acid, tech., bbl., lb.	.40 - .42	.40 - .42	.40 - .42
Solvent naphtha, w.w., tanks, gal.	.26 -	.26 -	.26 -
Toluidine, bbl., lb.	.88 - .90	.88 - .90	.88 - .90
Toluene, tanks, works, gal.	.30 -	.30 -	.30 -
Xylene, comm., tanks, gal.	.26 -	.26 -	.26 -

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech., bbl., lb.	.12 - .13	.12½- .13	.14½- .15
China clay, dom., f.o.b. mine, ton	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors:			
Carbon gas, black (wks.), lb.	.04 - .20	.04 - .20	.02½- .20
Prussian blue, bbl., lb.	.35½- .37	.35½- .37	.35 - .36
Ultramine blue, bbl., lb.	.06 - .32	.06 - .32	.06 - .32
Chrome green, bbl., lb.	.26 - .27	.26 - .27	.27 - .30
Carmine red, tins, lb.	4.00 - 4.40	4.00 - 4.40	3.90 - 4.50
Para toner, lb.	.80 - .85	.80 - .85	.75 - .80
Vermilion, English, bbl., lb.	1.58 - 1.60	1.58 - 1.60	1.32 - 1.35
Chrome yellow, C. P., bbl., lb.	.15 - .16	.15 - .15½	.15 - .15½
Feldspar, No. 1 (f.o.b. N.C.), ton	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb.	.07 - .08½	.07 - .08½	.07 - .08½
Gum copal Congo, bags, lb.	.09 - .10	.09 - .10	.06 - .08
Manila, bags, lb.	.09 - .10	.09 - .10	.16 - .17
Damar, Batavia, cases, lb.	.15½- .16	.15½- .16	.16 - .16½
Kauri No. 1 cases, lb.	.20 - .25	.20 - .25	.45 - .48
Kieselguhr (f.o.b. N.Y.), ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc, ton	50.00 -	50.00 -	40.00 -
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H., bbl.	5.55 -	5.35 -	5.10 -
Turpentine, gal.	.48 -	.47½-	.49½-
Shellac, orange, fine, bags, lb.	.35 -	.35 -	.24 - .25
Bleached, bonedry, bags, lb.	.32 - .33	.32 -	.24 - .25
T. N. bags, lb.	.26 - .27	.26 - .27	.15 - .16
Soapstone (f.o.b. Vt.), bags, ton	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.), ton	8.00 - 8.50	8.00 - 8.50	8.00 - 8.50
300 mesh (f.o.b Ga.), ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
325 mesh (f.o.b N. Y.), ton	13.75 -	13.75 -	13.75 -

INDUSTRIAL NOTES

WEST END CHEMICAL CO., Oakland, Calif., has moved its offices from the Syndicate Bldg. to the Latham Square Bldg., Sixteenth St. and Telegraph Ave.

THE JEFFREY MFG. CO., Columbus, Ohio, announces the appointment of Alphonse F. Brosky as special engineer attached to the general offices at Columbus.

HEVI DUTY ELECTRIC CO., Milwaukee, has appointed the Production Tool & Supply Co., 2832 Easton Ave., St. Louis, as service and sales agents for its electric heat treating furnaces for the state of Missouri.

NATIONAL CARBON CO. INC., New York, has purchased the carbon electrode plant of Republic Carbon Co., of Niagara Falls. There will be no change in the operating or sales personnel of the latter company.

ALLIS-CHALMERS MFG. CO., Milwaukee, announces the removal of its Chicago district office to the new Field Bldg., 135 South LaSalle St. B. F. Bilsland is manager of the Chicago office.

THE BROWN INSTRUMENT CO., Philadelphia, announces the appointment of L. Morton Morley as general sales manager. Mr. Morley will have complete supervision of all sales, advertising, and sales promotional activities.

THE PFAUDLER CO., Rochester, N. Y., has appointed Harold J. Grieve as representative in the Pittsburgh territory. Mr. Grieve has been with Pfaudler for more than 10 years and for some time prior to 1929 represented the company in Pittsburgh.

THE W. S. TYLER CO., Cleveland, has acquired all the United States patents and pending patent applications under which vibrating screens, washing and scrubbing apparatus have heretofore been manufactured by the Niagara Concrete Mixer Co., Buffalo, N. Y.

HAROLD E. TRENT CO., Philadelphia, has opened an office at 143 Liberty St., New York, with A. H. Gurtner in charge.

E. I. DU PONT DE NEMOURS & CO., Wilmington, Del., through receivers sale, has purchased the Mountain Varnish & Color Wks., Inc., of Toledo.

NEW CONSTRUCTION

Where Plants Are Being Built in Process Industries

	Current Projects: Proposed Work and Bids	Current Projects: Contracts Awarded	Cumulative to Date: Proposed Work and Bids	Cumulative to Date: Contracts Awarded
New England	$120,000	$29,000	$1,135,000	$1,148,000
Middle Atlantic	888,000	1,205,000	4,209,000	3,094,000
Southern	455,000	750,000	12,415,000	7,537,000
Middle West	430,000	.....	8,450,000	1,851,000
West of Mississippi	425,000	.....	15,499,000	564,000
Far West	550,000	39,000	3,352,000	419,000
Canada	162,000	28,000	3,280,000	963,000
Total	$3,030,000	$2,051,000	$48,340,000	$15,157,000

PROPOSED WORK
BIDS ASKED

Alcohol Plant—U. S. Industrial Alcohol Co., Curtis Bay, Baltimore, Md., is receiving bids for alterations to its factory here. Estimated cost $150,000.

Carbon Black Plant—B. H. Ashe, Engr., Guymon, Okla., plans the construction of a carbon black plant in the Guymon gas fields. Estimated cost $275,000.

Carbon Dioxide Plant—The Liquid Carbonic Corp., 41 Mill St., Toronto, Ont., Can., plans the construction of a plant for the manufacture of carbon dioxide and dry ice. Estimated cost $50,000.

Cement Treatment Plant—Santa Cruz Portland Cement Co., Crocker Bldg., San Francisco, Calif., is having plans prepared for the construction of cement treatment plant on West 7th St., Long Beach, Calif. Project will include treatment mill, steel silos and sacking bins. R. A. Kinzie is chief engineer. Estimated cost $250,000.

Charcoal Plant—Hagman Bros., Coles St., Jersey City, N. J., contemplates the construction of a charcoal plant at 33 Division St., Jersey City. Estimated cost $30,000.

Chemical Plant—Merck & Co., Rahway, N. J., will soon take bids for altering and enlarging its plant here. Estimated cost $30,000.

Chemistry and Science Building—Kansas State College, Manhattan, Kan., contemplates the construction of a chemistry and science building. Estimated cost $150,000.

Chemical Laboratory—State, Commissioner of Agriculture, Tallahassee, Fla., soon lets contract for the construction of a 2 story laboratory. Estimated cost $50,000.

China Factory—The Cronin China Co., Daniel Cronin, Pres., New Cumberland, W. Va., plans to purchase the two idle factories of the former Owen China Co., Minerva, O., and will rehabilitate them, construct new tunnel kiln and make other improvements. Estimated cost $30,000.

Distillery—New York & Kentucky Co., 7 East Seneca St., Buffalo, N. Y., plans to construct a distillery, including an office building at Waterloo, N. Y. Henry M. Naylor, c/o Owners, is in charge of project. Estimated cost $150,000.

Distillery—Winand-Pikesville Distillery Co., 1920 Belair Rd., Baltimore, Md., plans to alter and enlarge its distillery in the vicinity of Baltimore. Estimated cost $100,000.

Distillery Warehouse—Trenton Valley Distillers Corp., Harry Low, Gen'l Mgr., Trenton, Mich., plans the construction of a warehouse addition, to have a capacity for 20,000 bbls. G. F. Diehl, 120 Madison Ave., Detroit, Mich., is architect.

Dehydrating Plant—East Crest Holding & Development Co., Ltd., Calgary, Alta., Can., plans the construction of a dehydrating plant for the recovery of sodium sulphate deposits from Whiteshore Lake.

Glass Factory—Hazel-Atlas Glass Co., 15th and Jacob Sts., Wheeling, W. Va., plans to construct an addition to its factory. Fred Faris, 117 Chapline St., Wheeling, is architect. Estimated cost $125,000.

Laboratory—Gulf Refining Co., Gulf Bldg., Pittsburgh, Pa., will soon award the contract for a group of three buildings to be used as a research laboratory at Harmarville, Pa. H. H. Henderson, Pittsburgh, is chief engineer. Estimated cost $150,000.

Laboratory—U. S. Department of Agriculture, Division of Purchases and Sales, Wash., D. C., will receive bids until Aug. 24 for the construction of a 2 story, 62x102 ft. fruit products laboratory at the Horticultural Farm, Beltsville, Md. Estimated cost $100,000.

Linoleum Factory—Barry & Staines, Ltd., Farnham, Que., Can., plans the construction of an addition to their factory.

Paper Mill—Premier Pulp & Paper Corp., Chandler, Que., Can., contemplates the construction of a mill.

Paper Mill—Roundout Paper Mills, Napanock, N. Y., W. P. Kelly, Pres., contemplates the construction of a paper mill. Estimate exceeds $100,000.

Paper Box Factory—The St. Johns Paper Box Co., St. Johns, Que., Can., subsidiary of Dominion Blank Book Co., Ltd., plans to enlarge its factory.

Potato Starch Plant—Potato Starch Products, Inc., Quitman, Ga., contemplates the construction of a potato starch plant. Estimated cost $280,000.

Rubber Cement Plant—Braintree Rubber Cement Co., lessee, Braintree, Mass., plans to rebuild plant here damaged by fire. Estimated cost $30,000.

Soap Factory—Andrew Jergens Co., 2535 Spring Grove Ave., Cincinnati, O., is having plans prepared by Tietig & Lee, Archts., Cincinnati, for the construction of an 8 story factory. Estimated cost $400,000.

Tannery—Neponset Tanning Co., 68 Devonshire St., Boston, Mass., had plans prepared by Thomas B. Hamilton, Archt., 421 Marlboro St., Boston, for the construction of a tannery on Tenean St., Dorchester, Mass. Estimated cost $90,000.

Varnish Factory—McCloskey Varnish Co., Rhawn St. and State Rd., Philadelphia, Pa., has purchased a two acre site at 5475 East Slauson St., Maywood, Calif., and plans to construct a plant and warehouse for the manufacture of technical varnishes, driers and grinding fluids used by paint manufacturers. Estimated cost $150,000.

Cyanide Mill—Buckskin National Gold Mining Co., Reno, Nev., plans the construction of a 50 ton cyanide mill and other structural improvements at its property here. W. J. Bell, Winnemucca, Nevada, is president. Estimated cost $150,000.

Warehouse—Pringle Powder Co., Bradford, Pa., plans the construction of a 1 and 2 story, 22x88 ft. warehouse. F. A. Fensel, Hooker Fulton Bldg., Bradford, is architect.

CONTRACTS AWARDED

Brass Factory—Revere Copper & Brass, Co., J. D. Blake, engineer in charge, Rome, N. Y., awarded contract for 1 story, 90x120 ft. and 120x387 ft. factory, to Zingerling Bros., Front St., Rome. Estimated cost $105,000.

Calcium Chloride Plant—The Brunner Mond Co., manufacturer of chemical products, Amherstburg, Ont., Can., is building a 1 story, 100x200 ft. factory for the manufacture of calcium chloride. Work is being done by day labor under supervision of owner's engineers.

Distillery—Churchill Downs Distillery co., c/o C. J. Frentz, President, 618 West Jefferson St., Louisville, Ky., is building a complete distillery on a site of 485 acres at Smith's Station, Smith's Grove, Ky. Work is being done largely by day labor. Complete distillery equipment will be purchased suitable for handling about 400 bu. of corn daily. Leslie V. Abbott, 8 Kenwood Village, Louisville, Ky., is architect. Estimated cost $150,000.

Distillery—Distillers Co., Ltd., 620 Fifth Ave., New York, N. Y., awarded contract for gin distillery on West Edgar Rd., Linden, N. J., to Turner Construction Co., Graybar Bldg., New York, N. Y. Estimated cost including equipment $1,000,000.

Distillery—Hendrick Hudson Distillery Co., 22 East 40th St., New York, N. Y., awarded contract for distillery at Kinderhook, N. Y., to A. E. Rosell, 22 East 40th St., New York, N. Y Estimated cost $100,000.

Distillery—Petri Wine Co., Battery and Valejo Sts., San Francisco, Calif., awarded contract for distillery at Escalon, Calif., to L. Franchesi, 1408 Jefferson St., San Francisco, Calif. Estimated cost excluding equipment $14,200.

Distillery—Roma Wine Co., Lodi, Calif., awarded contract for a 4 story distillery to L. Franceshi, 1990 Beach St., San Francisco, Calif. Estimated cost excluding equipment $25,000.

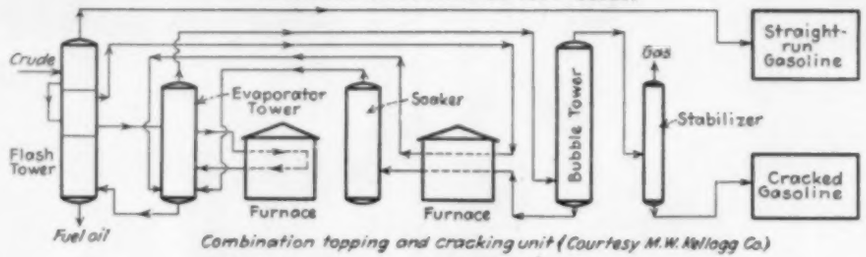
Insulated Board Factory—U. S. Gypsum Co., 300 West Adams St., Chicago, Ill., awarded contract for 1 story, 146x234 ft. addition to factory at Greenville, Miss., to H. K. Ferguson Co., Hanna Bldg., Cleveland O. Estimated cost $600,000.

Laboratory—Felters Co., West St., Millbury, Mass., awarded contract for laboratory to Crane Service Corp., Inc., 21 Glenwood Ave., Binghamton, N. Y. Estimated cost $28,500.

CHEM. & MET. FLOW SHEETS OF PROCESS INDUSTRIES

Continued from *Chem. & Met.*, July, 1934, page 396.

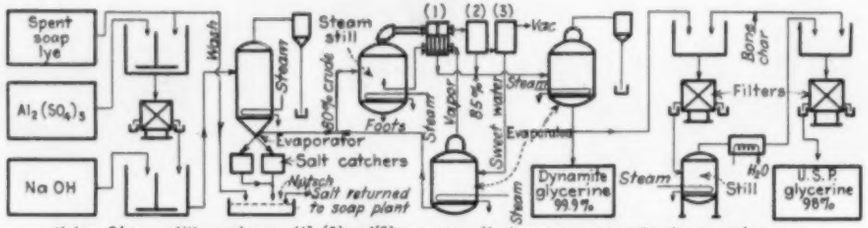
PETROLEUM REFINING (Cross Process)



Combination topping and cracking unit (Courtesy M.W. Kellogg Co.)

Gasoline	65-70 per cent	Yields on Mid-Continent crude
Fuel oil (approx.)	25 per cent	
Gas and loss	up to 10 per cent	

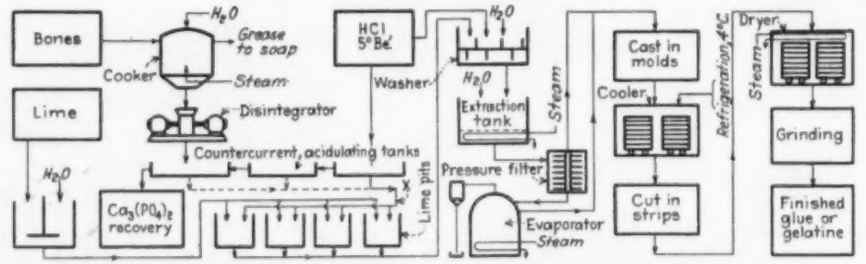
GLYCERINE



Note:- Steam still condensers (1), (2) and (3) are respectively a vapor superheater, an air or warm water partial condenser for 85% glycerine and a cold water final condenser for sweet water

Spent lye (glycerine, 5%)	22 tons	Steam	8,000 lb.	To produce glycerine, 1 ton salt, 2.2 tons
Caustic soda	200 lb.	Electricity	10 kw.-hr.	
Aluminum sulphate	176 lb.	Direct labor	4 man-hr.	
Bone char	100 lb.			

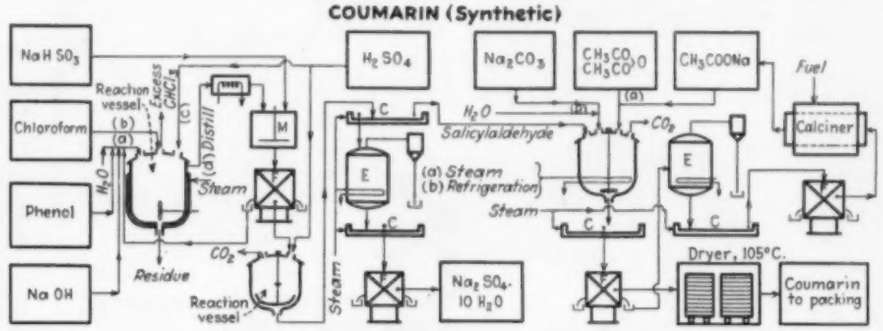
GLUE AND GELATINE



Note:- Manufacture of glue and gelatine differs largely in that poorer grades of raw materials and higher extracting temperatures are used for the former. Glue is more completely hydrolyzed than gelatine. Instead of bones, skins, hides, sinews, hide scraps, fleshings, fish stock, etc., may be used, in which case, after washing, they are introduced at X. Usually three extractions at temperatures from 60 to 75 deg. C. are used. The last extract requires concentration before molding

Bones	3.03 tons	Steam	400 lb.	To produce Gelatine, 1 ton; $Ca_3(PO_4)_2$ 1.67 ton; Grease, 0.08 ton
Hydrochloric acid	1.14 tons	Electricity	55 kw.-hr.	
Lime	0.76 tons	Direct labor	6 man-hr.	

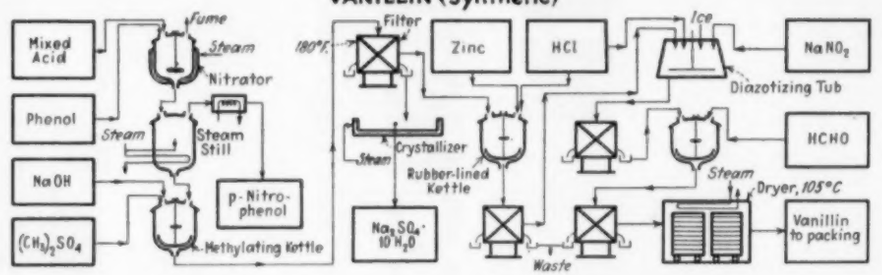
COUMARIN (Synthetic)



Key:- C, *crystallizer*; E, *evaporator*; F, *filter*; M, *mixer*

Phenol	150 lb	Sodium acetate	25 lb.	To produce coumarin, 100 lb. or salicylaldehyde, 75 lb.
Chloroform	25 lb.	Sodium carbonate	40 lb.	
Caustic soda	75 lb.	Steam	150 lb.	
Sulphuric acid	95 lb.	Refrigeration (ice equiv.)	200 lb.	
Sodium bisulphite	50 lb.	Electricity	45 kw.-hr.	
Acetic anhydride	75 lb.	Direct labor	4 man-hr.	

VANILLIN (Synthetic)



Mixed acid	1,200 lb	Hydrochloric acid	63 lb.	To produce vanillin, 100 lb; p-nitrophenol, 170 lb.; $Na_2SO_4 \cdot 10H_2O$, 4,835 lb
Phenol	400 lb	Sodium nitrite	50 lb.	
Caustic soda	750 lb	Formaldehyde	117 lb.	
Methyl sulphate	27 lb.	Direct labor	7 man-hr.	
Zinc	20 lb	Steam	2,000 lb.	